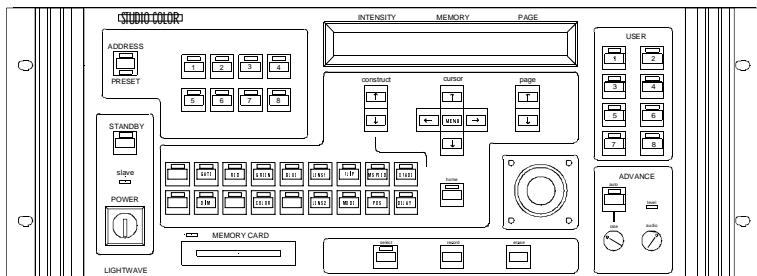


# *LCD Controller for*

# STUDIO COLOR<sup>TM</sup>

## *User Manual*



High End Systems Inc.  
2217 West Braker Lane  
Austin, Texas 78758  
U.S.A.



# **LCD Controller for**

# **STUDIO COLOR<sup>TM</sup>**

## *User Manual*

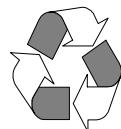
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LCD Controller for Studio Color User Manual  
P/N 60600079 Version 1.0 March 1997

Printed in the U.S.A.



# ***International Sales***

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# **Declaration of Conformity**

**according to ISO/IEC Guide 22 and EN45104**

**Manufacturer's name:** Lightwave Research  
**Manufacturer's address:** 2217 West Braker Lane  
Austin, Texas 78758 U.S.A.  
**Distributor's name:** High End Systems Inc.  
**Distributor's address:** 2217 West Braker Lane  
Austin, Texas 78758 U.S.A.

Declares that the product

**Product Name:** Studio Color LCD Controller  
**Product Number:** Studio Color LCD Controller  
**Product Options:** All

conforms to the following EEC directives:

73/23/EEC, as amended by 93/68/EEC  
89/336/EEC, as amended by 92/31/EEC and 93/68/EEC

Equipment referred to in this declaration of conformity first manufactured in 1995 in compliance with the following standards:

**Safety:** EN 60950 : 1992  
A1 : 1993  
A2 : 1994

<b>EMC:</b>	EN 55022	Class A ITE	December 1, 1995
	IEC 801-2 : 1991	Level 2 (4/8 kV)	November 29, 1995
	IEC 801-3: Draft 5	Level 2 (3 V/m)	November 29, 1995
	IEC 801-4: 1988	Level 2 (1kV/.5 kV)	November 29, 1995



U.S.A., Friday, September 12, 1997  
Lanny Derryberry, Compliance Engineer

## ***Important Safety Information***

INSTRUCTIONS PERTAINING TO CONTINUED PROTECTION AGAINST FIRE, ELECTRIC SHOCK, AND INJURY TO PERSONS ARE FOUND IN APPENDIX D.

READ ALL CAUTIONS AND WARNINGS PRIOR TO ASSEMBLY, MOUNTING, AND OPERATING THIS EQUIPMENT.

**IMPORTANT: INFORMATIONS DE SÉCURITÉ**  
INSTRUCTIONS RELATIVES À UNE PROTECTION CONTINUE CONTRE L' INCENDIE, LE CHOC ÉLECTRIQUE, ET CONTRE DES BLESSURES POSSIBLES SUR DES INDIVIDUS SE TROUVENT DANS L'APPENDICE D.

PRIÈRE DE LIRE TOUTES LES PRÉCAUTIONS ET LES AVERTISSEMENTS AVANT D'ASSEMBLER, DE MONTER, ET DE FAIRE FONCTIONNER CET ÉQUIPEMENT.

**WICHTIGE SICHERHEITSHINWEISE**  
DIE NACHSTEHENDEN HINWEISE BETREFFEN DEN SCHUTZ GEGEN BRAND, ELEKTRISCHEN SCHLAG, SOWIE VERLETZUNGEN. SIE BEFINDEN SICH IN APPENDIX D.

LESEN SIE ALLE WARNUNGEN SORGFÄLTIG, BEVOR SIE DAS GERÄT ZUSAMMENBAUEN, INSTALLIEREN UND BENUTZEN!

**INFORMACIÓN IMPORTANTE DE SEGURIDAD**  
SE ENCUENTRAN EN EL APÉNDICE D LAS INSTRUCCIONES CONCERNIENTES A LA PROTECCIÓN CONTINUA CONTRA INCENDIO, CHOQUE ELÉCTRICO, Y LESIONES A PERSONAS.

POR FAVOR LEA TODAS LAS PRECAUCIÓNS Y LAS ADVERTENCIAS ANTES DE ENSAMBLAR, MONTAR Y OPERAR ESTE EQUIPO.

**INFORMAZIONI IMPORTANTI DI SICUREZZA**  
ISTRUZIONI PERTINENTI LA PROTEZIONE CONTRO IL FUOCO, LE SCOSSE ELETTRICHE, I DANNI ALLE PERSONE SI TROVANO NEL APPENDICE D.

LEGGERE TUTTI GLI AVVERMENTI PRIMA DI MONTARE E USARE QUESTO APPARECCHIO.

# ***Warranty and Conditions***

---

## **Unpacking and Saving the Shipping Materials**

**Do not discard** the shipping carton and packing materials. The carton and packing materials are specifically designed to protect the product during transport.

High End Systems assumes no responsibility for products damaged during transport. Therefore, you should return a product for repair in its original shipping carton and packing materials.

**Note:** Before sending anything to the factory, be sure to call your HES Dealer/Distributor for a Return Authorization Number (RA#). Any goods shipped without an RA# will be refused at the factory.

## **Inspecting the Contents**

Carefully remove the contents of each shipping carton and inspect for signs of freight damage. If any such damage is found, you need to notify both the shipping agent and the sales agent immediately.

Any damage incurred in shipping is the responsibility of the carrier. In the case of hidden damage, a claim should be made as soon as discovered and all packing material retained for inspection.

**Note: Freight Damage Claims are invalid for fixtures or controllers shipped in non-factory shipping cartons and packing materials.**

## **Limited Warranty**

---

Unless otherwise stated, your product is covered by a two year parts and labor limited warranty. It is the owner's responsibility to furnish receipts or invoices for verification of purchase, date, and dealer or distributor. If purchase date cannot be provided, date of manufacture will be used to determine warranty period.

## **Returning an Item Under Warranty for Repair**

---

It is necessary to obtain a Return Authorization number (RA#) from your dealer or point of purchase **BEFORE** any units are returned for repair. The manufacturer will make the final determination as to whether or not the unit is covered by warranty.

Any Product unit or parts returned to High End Systems must be packaged in a suitable manner to ensure the protection of such Product unit or parts, and such package shall be clearly and prominently marked to indicate that the package contains returned Product units or parts and with a Returned Authorization (RA#) number. Accompany all returned Product units or parts with a written explanation of the alleged problem or malfunction.

**Please Note:** **Freight Damage Claims are invalid for fixtures shipped in non-factory boxes and packing materials.**

## ***Freight***

---

All shipping will be paid by the purchaser. Items under warranty shall have return shipping paid by the manufacturer only in the Continental United States. **Under no circumstances will freight collect shipments be accepted.** Prepaid shipping does not include rush expediting such as air freight. Air freight can be sent customer collect in the Continental United States.

REPAIR OR REPLACEMENT AS PROVIDED FOR UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY OF THE CONSUMER. HIGH END SYSTEMS, INC. MAKES NO WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO ANY PRODUCT, AND HIGH END SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. HIGH END SHALL NOT BE LIABLE FOR ANY INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGE, INCLUDING LOST PROFITS, SUSTAINED OR INCURRED IN CONNECTION WITH ANY PRODUCT OR CAUSED BY PRODUCT DEFECTS OR THE PARTIAL OR TOTAL FAILURE OF ANY PRODUCT REGARDLESS OF THE FORM OF ACTION, WHETHER IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE, AND WHETHER OR NOT SUCH DAMAGE WERE FORESEEN OR UNFORESEEN.

Warranty is void if the product is misused, damaged, modified in any way, or for unauthorized repairs or parts. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.



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# ***Introduction***

Congratulations on your purchase of the Lightwave Research® Liquid Crystal Display (LCD) controller for the Studio Color™ Automated Wash Luminaire. The Studio Color LCD controller provides designers and operators with the means to control the Studio Color family of luminaires quickly and powerfully.

Your microprocessor-based Studio Color fixture responds to an extensive set of programming commands called *constructs*. You can easily program these constructs into simple or complex pages (scenes), then play them back with the touch of a button. Pages or presets can also be played back from an analog controller in a remote location.

Once your pages are programmed and recorded, they are secure in the internal memory of the controller, protected by battery backup. You can protect programs from unauthorized editing by simply removing the power key switch. You can also store and transfer programs using either a removable PC Card memory adapter or a personal computer. Memories, pages and presets can also be crossloaded (transferred) directly from one controller to another controller.

## ***Features***

---

### **Programming:**

- Eight unique control channels for eight independently-operating fixtures per controller
- Each control channel can handle multiple Studio Color fixtures, if you want them to respond to commands in the same way
- Master/Slave capabilities allow you to control an unlimited number of independently-operating fixtures

- 891 pages (scenes)
- 9 memories
- Up to 1024 programmable presets from the front panel through the use of *preset banking*.
- Up to 1023 programmable presets using an analog controller, such as the Touch Dimmer Twelve manufactured by High End Systems, Inc.
- Up to 99 beam position presets for instant access and updates
- Page edit and page copy
- Memory lock
- 8 programmable User macro keys
- Fixture parameter viewing
- Page time delay
- Fixture exclusion
- Individual fixture homing
- User-selectable submasters
- Auto advance, audio advance and random advance

### **Constructs (programmable fixture features):**

- Six fixed color wheel positions, 16 forward/reverse spin speeds
- Continuously-variable fixed color wheel combinations
- Synchronized and unsynchronized (random) subtractive color mixing for multiple fixtures
- Smoothly-crossfaded and “snap” subtractive color mixing
- Wide and narrow beam shaping
- Adjustable beam position, also 99 beam position presets
- Adjustable dim
- Crossfade
- Color modulation

- Shutter strobing
- Color mixing
- Flip
- Frost effect
- Wide angle effect

### **Playback:**

- Supports the MIDI Show Control “Go” command
- Remote page and preset access
- Audio advance: page advance, page halt, color modulate, dim modulate
- Remote enable
- One-touch preset playback of pages or loops
- Variable-speed page advance
- Random advance
- Automatic all-memory playback (all programmed pages)

### **Other:**

- PC Card Type 1 adapter slot for backup and transfer of programs and operating system
- Professional induction joystick
- Durable polycarbonate front panel
- Self-test memory diagnostics
- Positive feel switches
- LCD display with adjustable backlight intensity

# **About This Manual**

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This manual provides easy-to-follow procedures for setting up and using your Studio Color LCD controller. It includes seven chapters and four appendices. First-time users should begin this manual with Chapter 1.

**Chapter 1: Preparing to Use Your LCD Controller** — unpacking your controller and setting the voltage, if required.

**Chapter 2: Setting Up Your Controller** — setting switches on the controller's rear panel, configuring and connecting fixtures, connecting cabling, master/slave controllers, MIDI connections and other connections.

**Chapter 3: Overview of Controller Operation** — general overview of concepts and terminology used in the manual, detailed explanation of constructs and their supported parameter values.

**Chapter 4: Basic Programming** — step-by-step instructions for creating a simple program, creating a loop, programming presets, playing back presets and programs, viewing programs, erasing pages, master dim, and homing fixtures.

**Chapter 5: Using the Menus** — navigating in the controller's menu system, selecting Lightwave Show Control or MIDI Show Control, locking/unlocking memory, erasing all memory, and setting backlight intensity.

**Chapter 6: Advanced Programming** — using position presets, address (fixture) parameter copy, the eight User keys, remote page and preset access, fixture lockout, audio playback, remote page access and remote enable/disable.

**Chapter 7: External Memory Storage and Transfer** — using a RAM card or personal computer for backup and restore.

**Appendix A: Binary Access Table** — listing of preset numbers (1 through 1023), preset keys, preset levels and analog-to-binary conversions.

**Appendix B: Construct Parameters** — lists all constructs supported by the Studio Color LCD controller, their allowable parameters values and default values.

**Appendix C: Pinouts and Wiring Diagrams** — diagrams of connector pinouts and wiring diagrams for experienced, technical users.

**Appendix D: Important Safety Information** — multi-lingual safety information and warnings that you must follow in order to safely operate the controller.

## **Symbols**

---

The following two international symbols appear in margins throughout this manual to highlight Caution and Warning messages.



**Note/Caution:** This symbol appears adjacent to Caution or Note messages. A Note is an advisory provided for your information. A Caution is an advisory warning; failure to heed a Caution could result in minor personal injury and/or damage to equipment.



**Electrical Shock:** This symbol appears adjacent to electrical shock warnings. Not heeding these messages could result in electrical shock and serious personal injury.



**Explosion:** This symbol appears adjacent to Explosion warning messages. These messages warn you about possible fire or explosive dangers.

# ***Getting Help***

---

**U.S. and  
Canada** From 8 a.m. to 6 p.m. (U.S. Central time)  
Monday through Friday: (800) 890-8989

24-hour FAX: (512) 834-9195

24-hour voice mail: (512) 837-3063 or  
(800) 890-8989

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FAX: +65 743 9322

# *Chapter 1*

# *Preparing to Use Your*

# *LCD Controller*

1

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# ***Unpacking Your Controller***

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First, unpack your controller and verify that it arrived complete and without any damage.

## ***Save the Shipping Materials***

**Do not discard** the shipping carton and packing materials. The carton and packing materials are specifically designed to protect the product during transport.

High End Systems, Inc. assumes no responsibility for products damaged during transport. Therefore, you should return a product for repair in its original shipping carton and packing materials.

**Note** Before sending anything to the factory, be sure to call your HES dealer/distributor for a Return Authorization (RA) number. The factory cannot accept any goods shipped without an RA number.

## ***Inspecting the Contents***

Carefully unpack the carton and inspect the contents for damage. If any of the items in the following list are missing or damaged you must notify both the shipping agent and your sales agent immediately:

- One copy of this manual
- One Studio Color LCD controller
- One 256KB PC Card (aka RAM Card) enclosed in a plastic container
- One Lightwave Research T-shirt
- One plastic container with two keys and one replacement fuse

# Specifications

This section lists specifications for your Studio Color LCD controller.

## Model and Part Numbers

- **Model:** Studio Color LCD Controller
- **Manufacturer:** Lightwave Research  
2217 West Braker Lane  
Austin, Texas 78758 U.S.A.  
U.S.A.
- **Distributor:** High End Systems, Inc.  
2217 West Braker Lane  
Austin, Texas 78758 U.S.A.
- **Product Number:** Studio Color LCD Controller

## Physical Specifications

- **Controller weight:** 21 lbs, 9.5 kg
- **Dimensions:** cm: 17.78 H x 48.29 W x 26.85 D  
in: 7.00 H x 19.00 W x 10.57 D

## Electrical Specifications

- **Rated Voltage:** 115/230 VAC Only
- **Rated Current:** .25/.15 A
- **Rated Frequency:** 50-60 Hz

## Fuses

The primary (line) fuse is accessed from the rear panel of the controller (5mm x 20mm):

- **115 V operation**—use 0.5 A, 250 V, Slow Blow Only
- **230 V operation**—use 0.3 A, 250 V, Slow Blow Only



**Class 1 equipment-For continued protection against electric shock, connect this equipment to a grounded power source only.**

**Use in dry locations only.**

## ***RAM Card***

256KB Static Random-Access Memory (SRAM), Type 1 PC Card (*nee* PCMCIA adapter).

(You can use a larger-capacity PC Card, but the controller utilizes only 256KB.)

One PC Card of this type is shipped with the controller. You can obtain additional/replacement adapters from your High End Systems dealer/distributor (part number 80440017).

## ***Safety Standards***

- EN 60950 : 1992
  - A1 : 1993
  - A2 : 1994
- UL 1950
- CSA 22.2 No. 950
- **EMC Standards**
  - EN 55022, Class A, ITE, December 1, 1995
  - IEC 801-2: 1991, Level 2 (4/8 kV), November 29, 1995
  - IEC 801-3: Draft 5, Level 2, (3 V/m), November 29, 1995
  - IEC 801-4: 1988, Level 2, (1kV/.5 kV), November 29, 1995

## Cables and Connectors

- **DMX data cables:** Belden® 9841 or equivalent (meets specifications for EIA RS-485 applications) with characteristics listed below:
  - 2-conductor twisted pair plus a shield
  - maximum capacitance between conductors - 30 pF/ft.
  - maximum capacitance between conductor and shield - 55 pF/ft.
  - maximum resistance of 20 W/1000 ft.
  - nominal impedance 100–140 W
  - 22–24 AWG with insulation having a dielectric rating of 300 volts or higher
- **DMX data connectors:** Standard 3-pin male and female XLR connectors
- **DMX data terminators:** Male XLR connector with 120 ohm terminator (see Chapter 2)
- **All other cables (listed below):** 2-conductor shielded cable
  - Master/Slave cable
  - Remote Enable cable
  - Stereo Audio Input cable
- **Remote enable connector:** 3.5 mm (1/8 in) tip/ring connector as shown in Figure 6-6 on page 6-30.
- **Connectors listed below:** 6mm (1/4 in) tip/ring/sleeve connector
  - Master/Slave connector
  - Stereo Audio Input connector
- **Cables for backing up or restoring memory using a personal computer:** see Chapter 7

## ***Optional Accessories***

---

Table 1-1 below shows the optional accessories for the Studio Color LCD controller available from your High End Systems dealer/distributor:

*Table 1-1. Studio Color Optional Accessories*

Name	Part Number
Status Cue® controller	Call*
Unprogrammed RAM card	80440017
Studio Color Upload Module	26040002
Heavy duty 3-pin XLR cable (10')	55050005
Heavy duty 3-pin XLR cable (25')	55050006
Heavy duty 3-pin XLR cable (50')	55050007
Heavy duty 3-pin XLR cable (100')	55050008

**Call\*** - Contact either your High End Systems dealer/distributor, High End Systems Sales, or the High End Systems World Wide Web site.

High End Systems International Sales: See the inside title page of this manual

High End Systems World Wide Web site:  
<http://www.highend.com>

# Setting the Controller Voltage

At the time of this writing, the Studio Color LCD controller is shipped from the factory set to 230V. Carefully examine the controller's voltage setting (as shown in Figure 1-1 on page 1-9), then follow the instructions in this section if you need to change it.



- Warnings**
- (1) Check the voltage selection switch before proceeding with the equipment setup!** Be sure to match the voltage selection switch to your power source prior to operating this equipment. *Do not set the voltage selection switch with the equipment plugged in.*
  - (2) Before selecting a voltage, you should verify the correct voltage setting with a local authority.** Selecting an incorrect voltage will result in an electric shock hazard and can cause injury to persons as well as damage the fixture. High End Systems, Inc. can accept no responsibility for damage to your controller or other equipment caused by an incorrect voltage setting.

## ***Set or Verify Controller Voltage***

To change or verify the controller's input voltage setting, locate the voltage selection switch on the rear panels shown in Figure 1-1 on page 1-9.

**115 volts** – This setting should be used for power supplies rated from 90V to 127V. Slide the switch so that “115” appears inside the switch opening. You must also do both of the following:

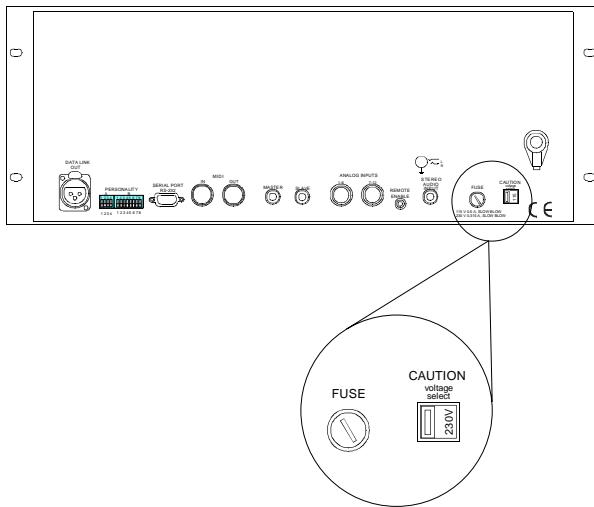
- Change the controller's fuse as shown in the section titled “Replacing the Fuse” on page 1-9.
- Verify the controller's frequency by setting personality switch B-2 as shown in the section titled “Switch B-2: Time Base” on page 2-6.

**230 volts** – This setting should be used for power supplies rated from 180V to 250V. Slide the switch so that “230” appears inside the switch opening. You must also do all of the following:

- See the section titled “Power Cord Cap” on page 1-10.
- Change the controller's fuse as shown in the section titled “Replacing the Fuse” on page 1-9.
- Verify the controller's frequency by setting personality switch B-2 as shown in the section titled “Switch B-2: Time Base” on page 2-6.



**Caution** **Do not plug a controller set to 115 volts into a 230 voltage source. Permanent damage will occur.**



*Figure 1-1. Location of the controller's voltage selection switch and fuse.*

## ***Replacing the Fuse***

You must replace the controller's fuse whenever you change the voltage setting or after the fuse becomes damaged.

Before attempting to replace the controller's fuse, you must obtain a replacement fuse *of the same type and rating*. Both fuses listed below are 5mm x 20mm.

**115 V operation**—use 0.5 A, 250 V, Slow Blow Only

**230 V operation**—use 0.3 A, 250 V, Slow Blow Only



1. Unplug the controller from the power source.
2. Using a small screwdriver, carefully push in on and turn the fuse holder counter-clockwise and remove it from the controller. The fuse holder is shown in Figure 1-1.
3. Replace the fuse with one *of the same type and rating only!*
4. Carefully insert the fuse holder back into the controller and retighten it by turning it clockwise.
5. If this is a new controller, continue with Chapter 2.

## ***Power Cord Cap***

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If you wish to attach the controller to a 230VAC outlet, you must replace the molded power cord cap provided with the controller with another suitable type of power cord cap. The type of power cord cap you must obtain depends on the location in which the controller will be used.

**Note** Because of the wide variety of power cord caps used worldwide, High End Systems, Inc. cannot make specific recommendations for the particular power cord cap you should use. Contact a local authority if you are unsure which type of power cord cap you need.

**IMPORTANT** The cores in the mains lead are colored in accordance with the following code:

- **green and yellow:** earth
- **blue:** neutral
- **brown:** live

### ***Important Power Cord Cap Information - U.K. Only***

Since the colors of the cores in the mains lead of this equipment may not correspond with the colored markings identifying the terminals in your plug, proceed as follows:

- The core which is colored green and yellow must be connected to the terminal in the plug which is marked with the letter “E” or by the earth symbol , or colored green or green and yellow.
- The core which is colored blue must be connected to the terminal which is marked with the letter “N” or colored black.

- The core which is colored brown must be connected to the terminal which is marked with the letter “L” or colored red.

**Class 1 equipment: THIS EQUIPMENT MUST BE EARTHED.**

1

## **Vigtig Sikkerhedsinformation - DANMARK**

**Advarsel: Beskyttelse mod elektrisk chock.**



Vigtigt!

Ledere med gul/groen isolation maa kun tilsluttes klemme  
maerket eller



# ***Chapter 2***

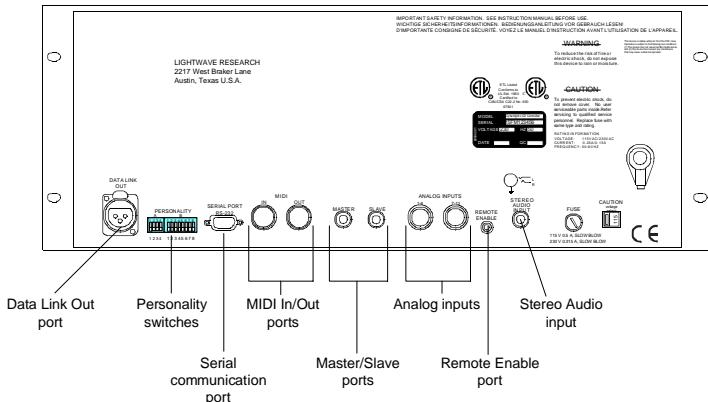
# ***Setting Up Your Controller***

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# Rear Panel Descriptions

Figure 2-1 shows the locations of the connectors on the rear panel of the Studio Color LCD controller.



*Figure 2-1. Connectors on the controller's rear panel.*

**Data Link Out port:** An XLR female jack that sends control data to all connected fixtures. For more information, see the section titled “Connecting Fixtures” on page 2-9.

**Personality switches:** The four switches in switch block A are reserved for future use. The eight switches in switch block B define the controller’s modes of operation. For more information, see the section titled “Setting the Switches” on page 2-4.

**Serial communication port:** Standard PC AT® style 9-pin serial communications port conforming to the RS-232C (also known as EIA-232-D) standard. This port is used for playback control using Lightwave Control Center (LCC) software, or for backing up/restoring memories and pages using a personal computer. The port operates at 9600 baud, 8 data bits, no parity, and 1 stop bit. For more information, see the section titled “Other Connectors” on page 2-23.

**MIDI In/Out ports:** Where MIDI signals enter and exit the controller using standard MIDI connections. The controller supports the MIDI Show Control “GO” command. For more information, see the section titled “MIDI In and Out Ports” on page 2-22.

**Master/Slave ports:** Ports for interconnecting master and slave controllers. Use the master/slave feature to expand the system to more than 8 unique fixtures. For more information, see the section titled “Master and Slave Controllers” on page 2-20.

**Analog inputs:** Locking 8-pin DIN connectors that enable remote recall of pages or presets using an analog controller, or that allow an analog controller to act as a submaster. For more information, see the section titled “Other Connectors” on page 2-23.

**Remote Enable port:** Enable/disable the controller from a remote location. For more information, see “Remote Enable” on page 6-30.

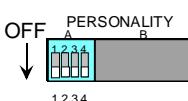
**Stereo Audio Input:** Use a stereo source to trigger audio effects, such as audio advance, color, and dim modulate. The sensitivity of the audio effects is controlled from the front panel of the controller using the Audio knob. For more information, see the section titled “Audio Input Playback” on page 6-27.

# ***Setting the Switches***

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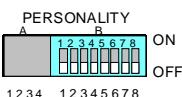
The two blocks of Personality DIP (dual in-line package) switches located on the controller's rear panel are labeled A and B.

## ***Configuring Switch Block A***



Switch block A is currently not used, and all four switches must be set to the OFF position.

## ***Configuring Switch Block B***



This section describes the functions of the eight switches in Personality switch block B.

### **All Switches OFF: Default Configuration**

The controller is shipped with all Personality "B" switches set OFF, which configures the controller as follows:

- Master controller
- 60Hz input voltage frequency (see page 2-6)
- Page access (see page 2-6)
- Twelve-level preset access (see page 2-7)
- Dependent presets (see page 2-7)

### **Switch B-1: Master or Slave**

Each controller supports up to 8 unique fixtures (8 fixtures that can be programmed to operate independently of each other). In order to expand your system to more than 8 independently-programmable fixtures, you can interconnect master and slave controllers.

You can set the controller to operate as either a master or a slave (there can be only one master controller per link). Your choice of master and slave controllers determines the following:

- The *master* controller determines the modes of playback for all controllers that are slaved to it. The master controller sets all standby, advance, and modulate settings. Only the master controller accepts commands from a lighting console, if any. Only one master controller is allowed per link.
- The *slave* (also called *slaved*) controllers retain their programming and editing functions, but cannot play back any programs. The accessible function keys on the slaved controllers are the power key switch, <Home>, <Select>, <Record>, <Erase>, and all of the Construct keys. There is no limit to the number of slaved controllers that can be attached to the master controller.

**Switch B-1 Off (default; correct setting for a stand-alone controller)** – the controller functions as a master and determines the modes of playback for all controllers that are slaved to it. The slave LED indicator will be OFF when the controller is set as a master. All front panel keys function normally.

**Switch B-1 On** – the controller operates as a slave. The slave controller can be connected the master controller via the Slave port located on the rear panel of the controller. The Slave LED located above the power key switch is ON when the controller has been configured as a slave.

## **Switch B-2: Time Base**

Switch B-2 sets the controller's input voltage frequency at either 50 Hz or 60 Hz. This setting must match the input voltage frequency of your power source because the controller senses this frequency as part of its internal timing circuits.

**Switch B-2 Off (default)** – the controller operates at 60 Hz

**Switch B-2 On** – the controller operates at 50 Hz



**Caution** **Selecting the incorrect time base (frequency) will result in erratic program playback. In general, the default setting (60 Hz) is appropriate for North American countries and the 50 Hz setting is appropriate for European countries. Consult a local authority if you are unsure which time base setting to use.**

## **Switch B-3: Page or Preset Access**

Switch B-3 determines how the controller responds to the Analog Inputs port as follows (for more information, see the section titled “Remote Page Access” on page 6-16 and “Remote Preset Access” on page 6-18).

**Switch B-3 Off (default)** – An attached analog controller accesses the pages in memory.

**Switch B-3 On** – An attached analog controller selects the controller’s preset levels.

## **Switch B-4: Not Used**

This switch is not used and should always be set OFF.

## Switch B-5: Binary Preset Access

**Switch B-5 Off (default)** – (Twelve-level preset access.) An analog controller accesses each of 8 presets on 12 independent levels for a total of 96 presets. You must also select preset level access by setting switch B-3 ON.

**Switch B-5 On** – When switch B-5 is ON, an analog controller accesses the first 10 of the 12 analog input channels in binary combinations to provide remote access to 1023 presets. You must also select preset level access by setting switch B-3 ON.

Channels 11 and 12 control blackout and standby, as shown below:

- **Channel 11 (blackout):** closes all fixtures' shutters but wheels and effects continue to run.
- **Channel 12 (standby):** activating channel 12 when the controller is in standby (Standby LED is ON) takes the controller out of standby. Activating channel 12 when the controller is *not* in standby (Standby LED is OFF) has no effect. When the controller is in standby, all fixtures' shutters close and any in-progress wheel and effect changes stop immediately. Controller pages continue to advance.

## Switch B-6: Dependent/Independent Presets

Switch 6 sets the mode of the presets as they relate to the master controller.

**Switch B-6 Off (default)** – Dependent Presets; the controller behaves as follows:

- The master controller's master intensity setting controls slaves.
- Slaved controllers' modulation effects respond to audio input at the master controller.
- Presets use their programmed master intensity value.

**Switch B-6 On** – Independent Presets; the controller behaves as follows:

- The master intensity recorded in each preset is ignored. Master intensities will remain as-is during preset playback. Slave controller master intensity is not affected or controlled by the master controller. Slave controllers will each accept independent master dim settings via Lightwave Show Control protocol.
- Slaved controllers' modulation effects respond to the audio input of each individual controller. Sequencing (Auto, Audio 1 and 2) is controlled by the master controller.
- Each controller uses its local audio input for audio effects. Advance modes (Auto, Audio 1 and 2) are still determined by the master controller.

**Note** Although the intensity setting is not recalled, intensity is recorded with presets for compatibility with Dependent Presets.

## **Switches B-7 and B-8: Not Used**

Switches B-7 and B-8 are not used and should always be set OFF.

# ***Connecting Fixtures***

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2

The Studio Color LCD controller uses its native DMX 512 protocol (language) to control Studio Color fixtures.

## ***Configuring the Fixtures***

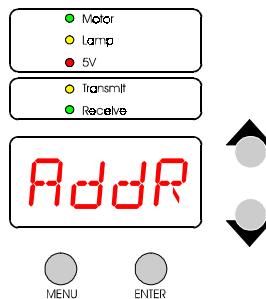
Before using the controller with Studio Color fixtures, you must do both of the following:

- Verify each fixture is using firmware version 38c or later.
- Select a fixture number for each fixture.

### ***Verifying the Firmware Version***

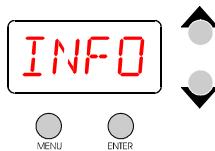
You can verify the firmware version using the fixture's Info menu as described below:

1. Press and hold down the <Menu> button on the fixture until the menu appears as shown below:



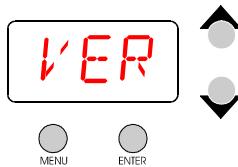
*Figure 2-2. The fixture's Addr(ess) menu is at the top level in the Studio Color menu system.*

2. Use the <Up> and <Down> arrow buttons located to the right of the display to select **Info**, as shown below:



*Figure 2-3. The fixture's Info menu displays information about the fixture, including the's current firmware version.*

3. Press the <Enter> button to view the Info menu items, then use the <Up> and <Down> arrow buttons to select **VER**, as shown below:



*Figure 2-4. The controller's Ver(sion) menu displays the current firmware version.*

4. Press the <Enter> button to view the firmware version. If the firmware version is 38C or above, no further action is required. Continue with the section titled “Setting A Fixture Number” on page 2-11.
5. If the firmware version is *below* (or less than) 38C, you must upgrade the firmware in one of the ways shown below:
  - If the firmware version is below (less than) 35, you must use the Status Cue console to upgrade it.
  - If the firmware version is above (greater than) 36, you can use the Studio Color Upload Module (part number 26040002) available from your High End Systems Inc. dealer/distributor. You can also use the Status Cue console.

- If the firmware version is above 38, you have three options: crossloading firmware from another fixture on the same DMX link, using the Studio Color Upload Module, or using Status Cue. Consult the *Studio Color User's Manual* for details about crossloading.

## Setting A Fixture Number

You must assign a unique fixture number, from 1 through 8, to each Studio Color fixture you wish to respond independently to control commands. Multiple fixtures can be assigned the same fixture number if you want them all to respond to the same set of control commands.

**Note** The Studio Color fixture has several built-in random (or unsynchronized) effects which work randomly even if multiple fixtures are assigned the same fixture number. For more information, see the section titled “Programming Hints” on page 3-2.

*Do not use a fixture number higher than 8 because the controller will send only fixture numbers 1—8.*

The order in which you assign fixture numbers is not important; use any numbering scheme you wish. (For example, the first fixture in the link does not have to be fixture number 1; it could be fixture number 8.)

1. Keep pressing the <Menu> button on the fixture until the menu appears as shown below:

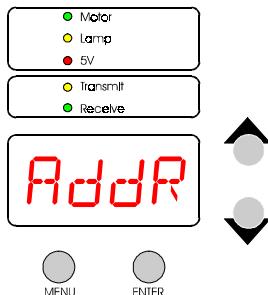


Figure 2-5. The controller's Addr(ess) menu allows you to set an fixture number from 1–8 so the controller will recognize the fixture.

2. Press the <Enter> button to view the current fixture number. It should appear in the format **F xx**, as shown below:

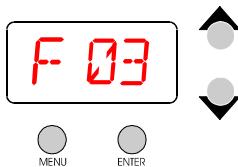


Figure 2-6. The fixture number display.



**Note** If the display is *not* in the format **F xx** as shown above, you must follow the instructions in the next section, titled “Selecting Fixture Numbering” on page 2-13. ***Do not continue with this procedure.***

3. Use the <Up> and <Down> arrow buttons to change the fixture number if you wish. *Do not select a fixture number higher than 8 (or F 08) because the controller will send only fixture numbers 1–8.*

**Note** You must select a unique fixture number for each fixture you wish to respond independently to control commands. Selecting the same fixture number for more than one fixture means that all fixtures will respond to the same set of control commands.

However, the Studio Color fixture has several built-in random (or unsynchronized) effects which work randomly even if multiple fixtures are assigned the same fixture number. For more information, see the section titled “Programming Hints” on page 3-2.

4. Press the <Enter> button to save the fixture number and continue with the section titled “Cables and Terminators” on page 2-14.

## Selecting Fixture Numbering

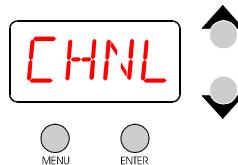
The Studio Color LCD controller *requires* each fixture to be assigned a fixture number rather than a DMX address, so if the display as shown in Figure 2-6 indicates the fixture is currently set for DMX address, you must change it using the procedure below:

1. Keep pressing the <Menu> button on the fixture until the display shows **ADDR** as shown in Figure 2-5 on page 2-12.
2. Use the <Up> and <Down> arrow buttons to select **SET** as shown below:



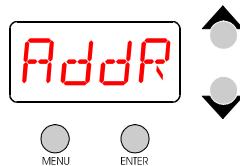
*Figure 2-7. The Set menu allows you to change various fixture parameters, including how fixtures are addressed.*

3. Press the <Enter> button, then use the <Up> and <Down> arrow buttons to select **CHNL** as shown below:



*Figure 2-8. The CHNL menu option selects either DMX addressing or fixture number “addressing”.*

4. Press the <Enter> button, then use the <Up> and <Down> arrow buttons to select **ADDR** as shown below:



*Figure 2-9. Configuring the fixture to be controlled by fixture numbers rather than DMX 512 addresses.*

5. Press the <Enter> button to save your selection, then keep pressing the <Menu> button until **ADDR** is again displayed.
6. Repeat the procedure in the section titled “Setting A Fixture Number” on page 2-11.

## **Cables and Terminators**

There are two main types of cabling you can use: data-grade cable and microphone cable. Although pin-compatible microphone cable is suitable for small-scale designs, data cable is recommended, especially for longer cable runs. Data cable is designed to carry a higher-quality signal with less susceptibility to electromagnetic interference.

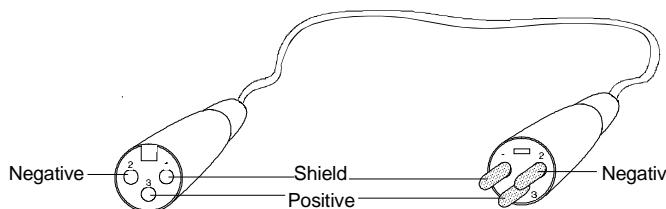
The cable you use should have the characteristics listed below:

- 2-conductor twisted pair plus a shield
- maximum capacitance between conductors - 30 pF/ft.
- maximum capacitance between conductor and shield - 55 pF/ft.
- maximum resistance of 20 Ω/1000 ft.
- nominal impedance 100–140 Ω
- 22–24 AWG with insulation having a dielectric rating of 300 volts or higher

Belden 9841 data-grade cabling meets specifications for EIA RS-485 applications and is highly recommended for use with Studio Color.

## Constructing Cabling

You should construct cables using shielded, two-conductor cable with a male 3-pin XLR connector at one end and a female 3-pin XLR connector on the other end. Pinouts for both male and female XLR connectors are shown in Figure 2-10.



**Female XLR connector**

**Male XLR connector**

*Figure 2-10. Properly-constructed data cable.*

You should test each cable with a voltage/ohm meter (VOM) to verify correct polarity and to make sure that the negative and positive pins are not grounded or shorted to the shield or to each other. Also, make sure that pin 1 is shielded.

*Table 2-1. XLR Cable Pinouts*

Pin 1 is the shield
Pin 2 is the data complement (negative)
Pin 3 is the data true (positive)



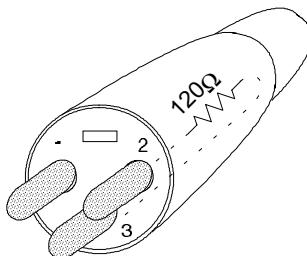
**Caution** **Do not use the ground lug on the XLR connectors. Do not connect the shield to ground or allow contact to ground. Grounding the shield could cause a ground loop and/or erratic behavior.**

## **Terminators**

The last device on each link must have a 120 ohm, 1/4 watt (minimum) terminator attached to its Data Out connector.

You can construct terminators by following the instructions in Figure 2-11:

1. Obtain a male XLR connector.
2. Disassemble the connector.
3. Solder a 120 ohm resistor, minimum of 1/4 watt, between pins 2 and 3.
4. Reassemble the connector.
5. Install the terminator in the Data Out port of the last device in the link.



*Figure 2-11. Constructing a data cable terminator.*

## **Connection Rules**

Before continuing, you need to understand the following rules:

- Each controller supports up to 8 unique fixtures. If you want to connect more than 8 fixtures to a controller, some of the fixtures will have to share the same fixture number, and will thus respond to the same set of control commands.

**Note** The Studio Color fixture has several built-in random (or unsynchronized) effects which work randomly even if multiple fixtures are assigned the same fixture number. For more information, see the section titled “Programming Hints” on page 3-2.

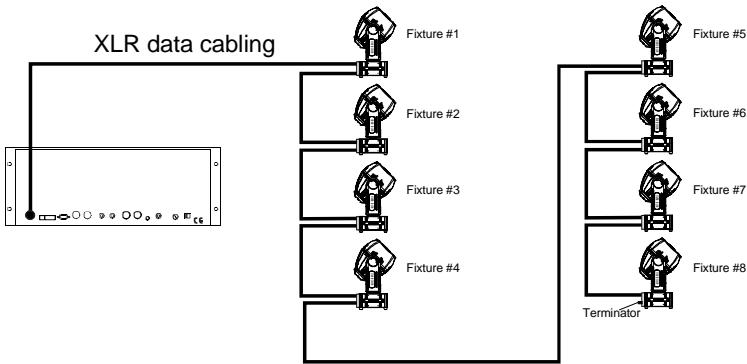
- You can expand your system beyond 8 independently-operating fixtures by connecting master and slave controllers together.

- A serial data distributor must be used if either of the following is true:
  - You wish to connect more than 32 fixtures to a controller or more than 32 master/slave controllers together.
  - The end-to-end cable span (the total length of all cables) on any link exceeds 500 ft. (153 m).

The serial data distributor regenerates and retimes the signal; failure to use it can result in data errors.

## Examples

*Example #1:* One controller is connected to 8 fixtures, each of which will respond independently to control commands.



8 independently-functioning fixtures,  
8 unique addresses

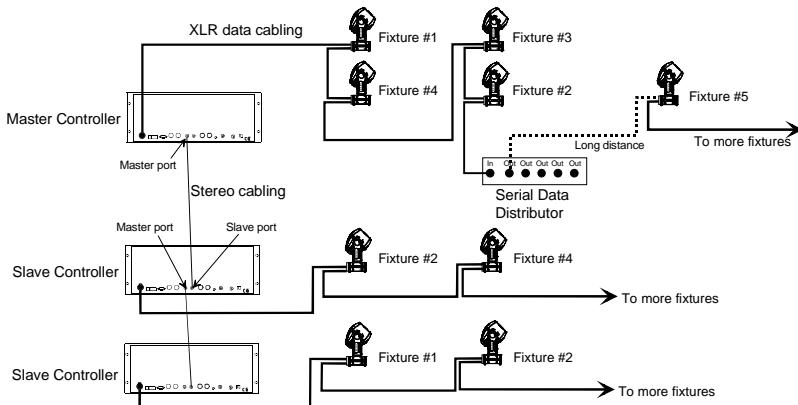
*Figure 2-12. Each of the eight fixtures connected to this controller responds independently to control commands.*

The example above shows one Studio Color LCD controller connected to 8 Studio Color fixtures. Each fixture is numbered 1 through 8 using the fixture's menus (see “Configuring the Fixtures” on page 2-9). A terminator must be attached to the Data Out connector of the last Studio Color fixture in the link (see “Terminators” on page 2-16).

Because each fixture has a unique fixture number, each one responds to commands from the controller independently from the other fixtures.

Since fewer than 32 Studio Color fixtures are attached to the controller and because no cable spans more than 500 ft. (153 m), a serial data distributor is not required.

*Example #2:* Multiple controllers are linked together as masters and slaves. One link spans more than 500 ft (153 m).



*Figure 2-13. This example shows three controllers interconnected via their Master and Slave ports. The master controller provides a single point of playback control.*

In the example above, three Studio Color LCD controllers are connected to multiple fixtures. The first controller is designated as the master controller by setting switch B-1 to OFF. The other two controllers are slaves (switch B-1 set to ON). *Only one master controller is allowed per link.*

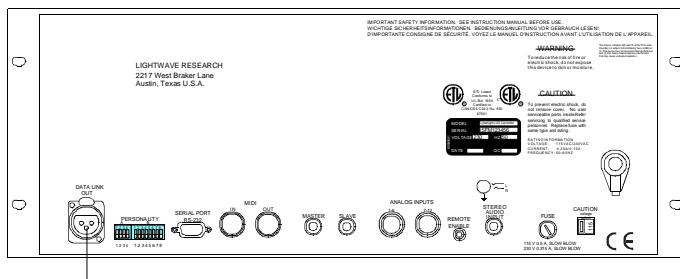
The master controller controls playback of programs that have already been created on the slaves. (You program the slave controllers independently, then play back the programs from the master controller.) The master controller can also

be linked to a lighting console via its MIDI, RS-232C or analog ports. *Only* the master controller (not the slaves) can accept commands from the lighting console.

The system shown in Figure 2-13 can support up to 24 independently-functioning Studio Color fixtures (8 for each of the three controllers). Also notice that fixtures are numbered non-sequentially. The Studio Color LCD controller recognizes fixtures numbered in any order you wish, as long as all fixtures are numbered between 1 and 8.

## ***Linking Fixtures to the Controller***

1. Start with the controller. Connect 3-pin data-grade XLR cable to its Data Out connector, as shown in Figure 2-14:



Attach a male 3-pin XLR connector

*Figure 2-14. Connect the male end of a 3-pin XLR cable to the controller's female Data Out port.*

2. Connect the female end of the XLR cable from the controller to the first Studio Color fixture's male Data In connector.
3. Connect the male end of another XLR cable to the first Studio Color fixture's female Data Out connector.
4. Continue connecting the Data Out connector from one Studio Color to the Data In connector to the next Studio Color until you have linked all of the Studio Color fixtures. It is not necessary to connect fixtures in any particular order; connect them in a way that results in the least amount of cabling.

5. Connect other devices to the Studio Color fixtures as desired, using the instructions in the documentation provided with those devices.
6. Place a male 120 ohm terminator on the female Data Out connector of the last device in the link. The procedure for making a terminator can be found in the section titled “Terminators” on page 2-16.

## ***Master and Slave Controllers***

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Each controller supports up to 8 unique fixtures (8 fixtures that can be programmed to operate independently of each other). In order to expand your system to more than 8 independently-programmable fixtures, you can interconnect master and slave controllers.

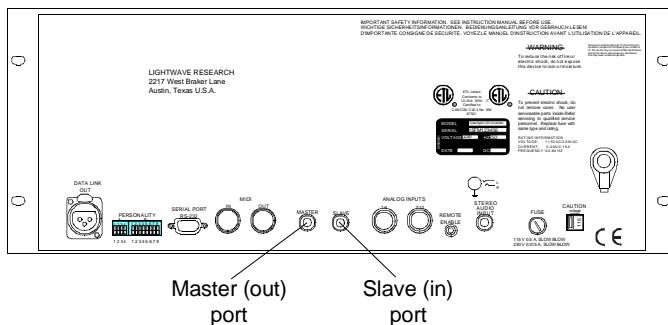
There is no limit to the number of slave controllers you can have in your system.

### **Designating Master and Slave Controllers**

The differences between master and slave controllers are explained below:

- The *master* controller determines the modes of playback for all controllers that are slaved to it. The master controller sets all standby, advance and modulate settings. Only the master controller (not any of the slaves) communicates with a lighting console, if any. Only one master controller is allowed per link.
- The *slave* (also called *slaved*) controllers retain their programming and editing functions, but cannot play back any programs. (Programs on the slaved controllers are played back by the master controller.) The accessible function keys on the slaved controllers are the power key switch, <Home>, <Select>, <Record>, <Erase>, and all of the Construct keys.

1. Set personality switch B-1 on the rear panel of each slaved controller to ON. Refer to Figure 2-1 on page 2-2 for the location of the switches. The Slave LED (located above the Power key switch) turns ON.
2. Connect a shielded, 2-conductor cable with a 6 mm (1/4 inch) tip/ring/sleeve connector on each end from the master controller's Master (out) connector located on the rear panel to the slave controller's Slave (in) connector.
3. To slave more than one controller to a master controller, continue connecting cables from one controller to the next, as shown in Figure 2-13 on page 2-18.



*Figure 2-15. Location of the Master and Slave ports on the controller's rear panel.*

# MIDI In and Out Ports

The controller supports the MIDI Show Control (MSC) “GO” command, a subset of the MIDI (Musical Instrument Digital Interface) specification. Typically, MSC is used either to connect different types of controllers to each other (for example, Studio Color LCD controllers and Intellabeam® LCD controllers), or to connect a master controller to a lighting console.

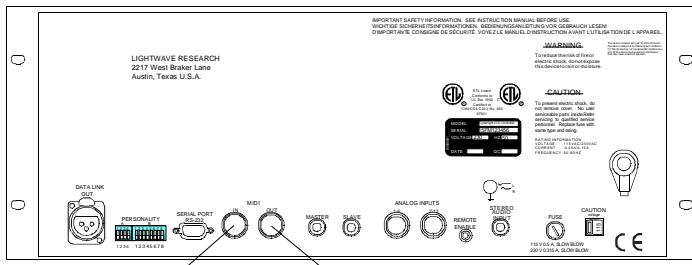
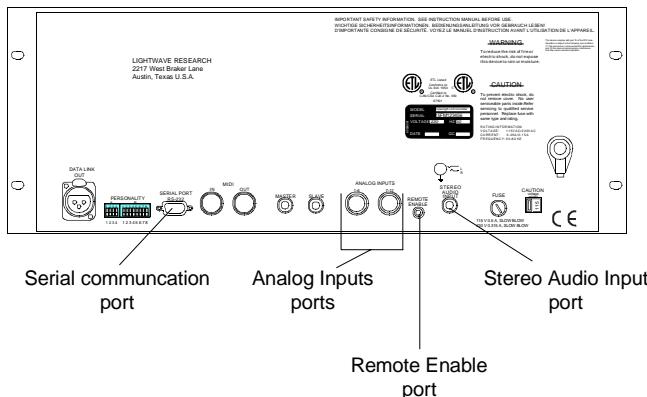


Figure 2-16. Location of MIDI In and Out ports.

## *Other Connectors*

This section describes how to connect cabling to the other connectors on the controller's rear panel. Because these other connectors are used in conjunction with advanced functions described further in Chapters 6 and 7, only a brief explanation is found here.



*Figure 2-17. Locations of the other connectors on the controller's rear panel.*

**Serial communication port:** Connect the male end of a standard 9-pin RS-232C serial communication cable to this port for playback control using Lightwave Control Center (LCC) software, or for backing up/restoring memories, pages and presets using a personal computer. The port operates at 9600 baud, 8 data bits, no parity, and 1 stop bit. For more details about using this port with LCC, see the section titled “Lightwave Control Center” on page 6-31. For more information about backup/restore, see Chapter 7.

**Analog Inputs ports:** Two locking 8-pin DIN connectors that enable the remote recall of pages or presets using an analog controller. The first connector is for analog channels 1 through 6; the second connector is for analog channels 7 through 12. For more details about the usage of this port, see the section titled “Analog Inputs Ports” on page 6-15.

**Remote Enable port:** Use the Remote Enable signal to enable and disable the controller from a remote location. Connect a shielded 2-conductor cable with a 3.5 mm (1/8") tip/ring connector to the controller's mini-microphone jack and use it as follows:

- 0 volts DC disables the controller (all fixtures go dark and all in-progress wheel and effects moves finish immediately)
- 5 volts DC (minimum) to 16 volts DC (maximum) to enable the controller (return it to its previous state of operation)

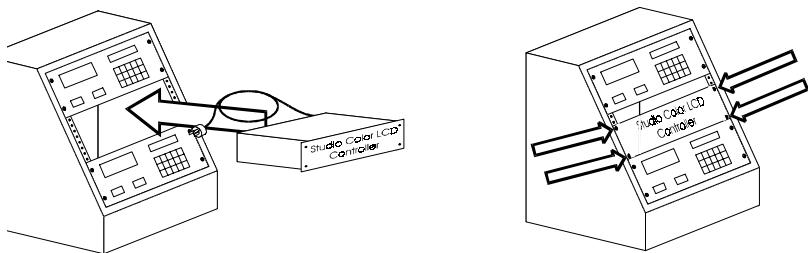
For more details about the usage of this port, see the section titled “Remote Enable” on page 6-30.

**Stereo Audio Input port:** Connect a shielded 2-conductor cable with a 6mm (1/4inch) tip/ring/sleeve connector to this port to control Studio Color fixture audio playback from a stereo source. Sensitivity to the audio signal is controlled from the front panel of the controller using the <Audio> knob. For more details about the usage of this port, see the section titled “Audio Input Playback” on page 6-27.

# Rack Mounting the Controller

After configuring the controller and connecting cables as described earlier in this chapter, you can mount the Studio Color LCD controller in a standard 19-inch rack as described in this section.

The Studio Color LCD controller is designed to mount into a standard 19-inch equipment rack as specified by the MIL-STD-189 and ANSI/EIA RS-310-C-77 specifications. The unit occupies four standard rack spaces.



1. Insert the unit into the front of the equipment rack. There must be at least 7 inches of available rack space. Be sure to feed the power cord in first, being careful not to pinch or otherwise damage the power cord. Do not use the unit if the power cord is damaged.
2. Attach the unit to the equipment rack by placing mounting screws through the two mounting holes behind the handles on each side of the controller. Attach the unit by the lower two mounting holes first as this is where the majority of weight is supported. Finish by attaching the unit through the remaining two holes.
3. The primary disconnect on this device is the power cord. The cord should be accessible or be placed into a power strip with an accessible on/off switch.

# ***Powering On the Controller***

---

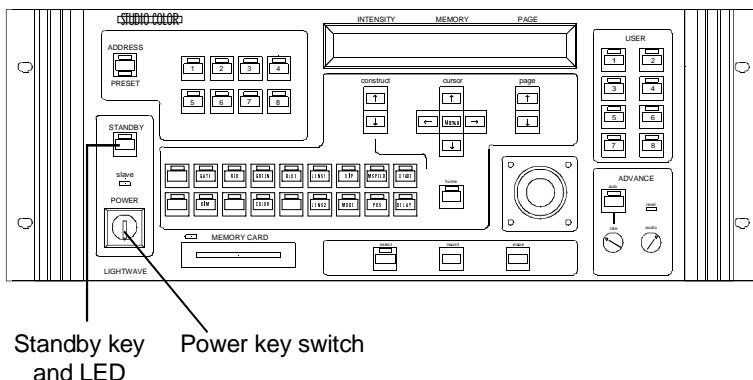
Before continuing, make sure you have done all of the following:

1. Selected the controller's voltage and frequency as described in the section titled "Setting the Controller Voltage" on page 1-7.
2. Installed the correct fuse as described in the section titled "Replacing the Fuse" on page 1-9.
3. Configured the controller's switches as described in the section titled "Setting the Switches" on page 2-4.
4. Configured and connected the fixtures as described in the section titled "Connecting Fixtures" on page 2-9. (Also see the *Studio Color User Manual* for additional details, such as mounting, not covered here.)
5. Connected cabling to the controller as described in the sections titled "Cables and Terminators" on page 2-14 and "Master and Slave Controllers" on page 2-20 and "MIDI In and Out Ports" on page 2-22 and "Other Connectors" on page 2-23.
6. *Optional.* Rack mounted the controller as described in the section titled "Rack Mounting the Controller" on page 2-25.

## ***Procedure for Powering On***

1. Connect all fixtures to suitable power outlets. Consult the documentation provided with the fixtures for details.
2. Power ON all fixtures connected to the Studio Color LCD controller. To turn on fixture power, press the "I" side of the fixture's power switch.

3. Insert the controller power key into the controller's front panel power key switch and turn the key clockwise. The location of the key switch is shown in Figure 2-18.



*Figure 2-18. Locations of the power key switch, the <Standby> key and Standby LED.*



**Caution** **Do not touch the joystick when applying power to the controller; the controller uses the initial position of the joystick as a reference point.**

4. The LCD window briefly shows the Boot version number and all LEDs flash. In a moment the Standby, Address, and any initialized or programmed Address/Preset LEDs light.
5. If a RAM card containing memory (memories, pages, presets, etc.) is inserted in the slot, the contents of the RAM card are checked against the contents of memory.
  - If the contents of memory and the RAM card match, the controller is placed in *mirror mode* and all future programming is automatically copied to the card.

- If the contents of memory and the RAM card do not match, the message below is displayed. If you want to save your programming to the RAM card, you must use the backup instructions in Chapter 5.

**Mirror mode card does not match memory.  
Use backup menu to activate mirror mode.**

6. If there is a RAM card containing operating system data in the RAM card slot, the LCD display shows a message that asks you whether or not you want to replace the controller's operating system with the operating system saved on the RAM card. Follow the instructions in the LCD display to proceed. If you do not respond within a few seconds, the controller performs its self-test.
7. If there is an incorrectly-formatted or blank RAM card inserted, an error message is displayed. You do not need to do anything; the controller will boot up normally.
8. After the RAM card operations, the controller performs a self-test. The LCD display shows: "**Checking memory x, Please wait.**" as it runs the self-test. The self-test counts through the memories from 1 to 9 slowly and then again quickly.
9. After the self-test, the controller's LCD display appears as shown below:

**Intensity: 99      Memory: 1      Page: 1**

10. At the same time, all connected fixtures are homed. Homing a fixture returns the wheels to their home (default) positions; and sets the dim, pan and tilt to their home (default) positions.

If any fixture fails to home, check its front panel display and refer to the *Studio Color User Manual* for troubleshooting suggestions.

# *Chapter 3*

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# ***Programming Hints***

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This section gives you a brief overview of some of the effects you can program using the Studio Color LCD controller.

## ***Color to Control***

The Studio Color fixture offers you a number of pre-programmed color effects to choose from. Except where noted, these options are covered in more detail in the section titled “Color Key” on page 3-15.

- **Synchronized, smooth crossfading between colors:** Use the Red-Green-Blue color mixing system to give you smooth transitions between colors (but never white) at a rate you set. If you have multiple fixtures selected, the color changes are synchronized between fixtures.
- **Unsynchronized, “random” color changes:** The Red-Green-Blue color mixing system is used to quickly snap to colors (but never white) at a rate you set. If you have multiple fixtures selected, the color changes are unsynchronized (different fixtures change to different colors).
- **Normal or double color mixing:** Use the Red-Green-Blue color mixing system either to continuously vary colors from 0 to 100% intensity (normal color mixing) or to rapidly change colors (double color mixing). See “Mode Key” on page 3-17.
- **Continuously-variable color combinations:** Select any one of the six positions on the fixed color wheel, or half-color combinations, or variations in between.
- **Color spins:** Spin the fixed color wheel in either a forward or reverse direction at a rate you set.

## Beam Shaping

The Lens 1 and Lens 2 constructs (corresponding to the two Studio Color effects wheels) control beam shaping. Each effects wheel has four positions (three effects plus open). The three effects positions include beam shaping plus one other effect, as described below:

**Lens 1** (see “Lens 1 Key” on page 3-11):

- **Beam shaping:** A long, narrow beam rotates into a short, fat beam.
- **Wide angle:** The “effect” position is wide angle—a large beam diameter with defined edges.

**Lens 2** (see “Lens 2 Key” on page 3-16):

- **Beam shaping:** A long, narrow beam rotates into a short, fat beam.
- **Frost:** The “effect” position is frost—soft, undefined beam edges.

## Random and Synchronized Effects

Unsynchronized (random) effects mean different fixtures are doing different things (“strobing” and/or changing colors) at the same time. These built-in effects require no additional programming.

### Random (Unsynchronized) Effects

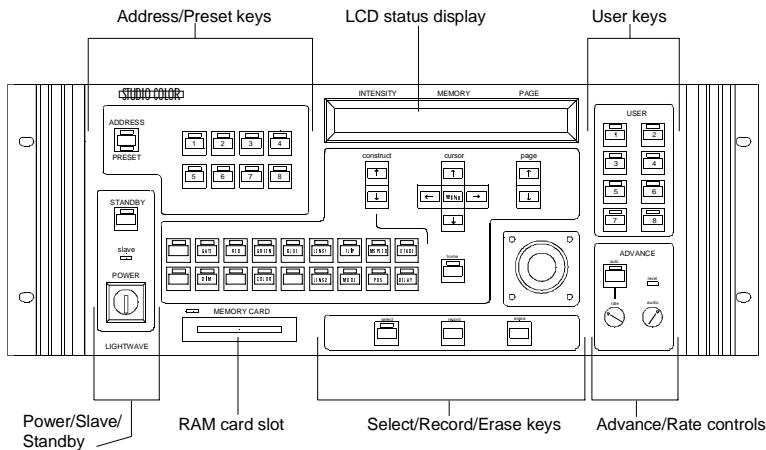
- **Shutter strobing:** Fixtures “strobe” at rates you set. See “Gate Key” on page 3-9.
- **Random color changes:** Fixtures rapidly “snap” to colors at rates you set. See “Color Key” on page 3-15.

### Synchronized Color Changes

Smooth crossfading between colors at rates you set. See “Color Key” on page 3-15.

# Front Panel Descriptions

Figure 3-1 is the first of two drawings that show groups of keys on the controller's front panel. Descriptions of these key groups follow the figure.



*Figure 3-1. First of two drawings showing the LCD controller's front panel.*

## Address/Preset keys:



<Address>/<Preset> key: This key toggles the controller between Address mode and Preset mode, described below. The controller's current state is indicated by either the Address or Preset LED being ON.

Each of the eight numbered keys has an LED that provides visual confirmation of active fixture numbers and presets.

- In **Address mode** (the default mode), these keys correspond to the eight fixture numbers. You use the eight Address keys to select one or more fixture numbers for programming, editing, or viewing parameters. An

Address LED is ON to indicate a fixture corresponding to that fixture number has been programmed with its light gate (shutter) open.

- In **Preset mode**, these keys correspond to eight programmable presets in each of the 128 *preset banks*. Each preset is capable of storing a single page or a loop of pages (up to 99 consecutive pages) for instant recall. A Preset LED is ON to indicate a stored preset.

For more information, see the section titled “Preset Programming” on page 4-19.

**LCD status display:** Displays current selections, menu choices, help or status information.

**User keys:** The controller has eight keys that can function as audio advance/modulate keys, or that you can custom program as macros. A *macro* is a recording of keystrokes that you assign to one of the User keys. Pressing that User key plays back the exact same sequence of keystrokes.

For more information, see the section titled “User Key Macros” on page 6-9 and “Audio Input Playback” on page 6-27.

### Power/Slave/Standy:



- The keyed power switch turns on the controller and enables any connected fixtures. The key provides protection from unauthorized users.
- When the Slave LED is ON, the controller is being used as a slave. For more information, see the section titled “Master and Slave Controllers” on page 2-20.
- Pressing the <Standby> key toggles the controller in and out of Standby; in Standby, all fixtures’ shutters close and any in-progress wheel or effect changes stop immediately. Controller pages continue to advance in Standby, however. The controller defaults to Standby whenever you power it up (the Standby LED is ON).

**RAM card slot:** Insert a RAM card (Type 1, 256KB SRAM PC Card) into this slot to store a copy of the controller's operating system, to install an updated version of the operating system, or to transfer programs into or out of the controller's memory. For more information, see Chapter 7.

### Select/Record/Erase keys:



- **Select key:** Use this key for programming, editing, and manual control of selected fixtures. For more information about programming, see Chapter 4.



- **Record key:** In Address mode, this key records the current page/scene for the selected fixture numbers (fixtures). In Preset mode, this key records a preset. For more information about programming, see Chapter 4.



- **Erase key:** Use this key to erase page memory, or to create an “un-initialized” page. For more information about un-initialized pages, see the section titled “Step 2: Record Un-Initialized Pages” on page 4-14.

### Advance/Rate controls:



- **Auto (advance) key:** When you press this key, the controller advances pages automatically at a rate set by the <Rate> knob. For more information, see the section titled “Setting Rate and Delay Time” on page 4-18.



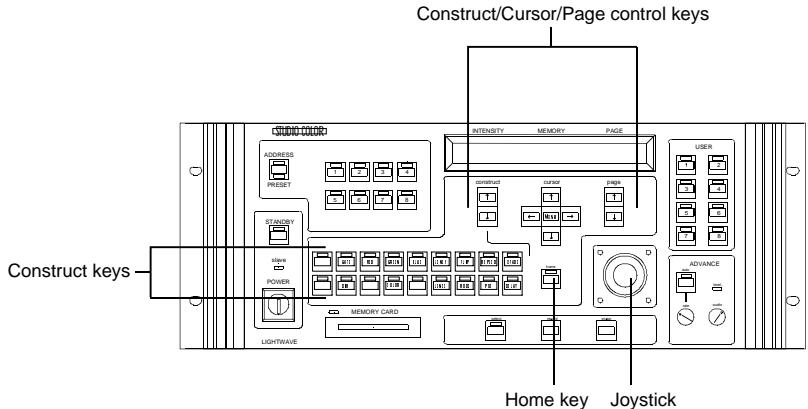
- **Rate knob:** Use this knob to regulate the speed of page changes in auto advance. For more information, see the section titled “Setting Rate and Delay Time” on page 4-18.



- **Audio knob:** Use this knob to adjust the controller’s audio sensitivity. For more information, see the section titled “Audio Input Playback” on page 6-27.



- **(Audio) level LED:** Displays the presence and relative strength of the audio input signal. For more information, see the section titled “Audio Input Playback” on page 6-27.



3

*Figure 3-2. Second of two drawings showing groups of keys on the Studio Color LCD controller's front panel.*

### Construct/Cursor/Page control keys:

- **Construct Up and Down arrow keys:** Change the parameter (value) of the selected construct. For more information, see the section titled “Using the Construct Keys” on page 3-8.
- **Cursor arrow keys:** have different functions, depending on the context:
  - The <Up> and <Down> arrow keys change which memory you’re programming pages in. For more information about programming, see Chapter 4.
  - During programming, the <Left> and <Right> arrow keys move you through the list of constructs. For more information about programming, see Chapter 4.
  - When you are using the menus, the <Left> and <Right> arrow keys move you through the menu options, the <Down> arrow key moves you down through the menus one level at a time, and the <Up> arrow key moves you up through the menus one level at a time. For more information, see Chapter 5.
- **Page Up and Down arrow keys:** these keys change the page number (1–99).

**Construct keys:** Allow you to program Studio Color fixtures. For more information, see the section titled “Using the Construct Keys” on page 3-8.



**Home key:** Pressing this key then pressing one or more Address keys closes the shutter and returns the selected fixtures’ wheels and motors to their default (home) positions. For more information, see the section titled “Homing Fixtures” on page 4-29.

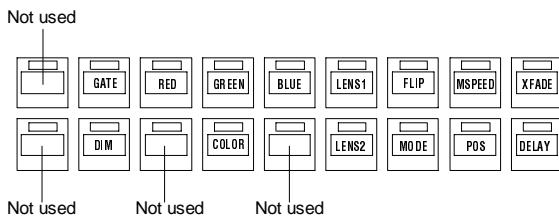
**Joystick:** Use the joystick to position the beams of selected fixtures during beam programming. For more information, see the section titled “Position Key (POS)” on page 3-19.

## ***Using the Construct Keys***

---

There are 14 Construct keys on the controller’s front panel that allow you to custom program Studio Color fixture features.

The Construct keys are shown in Figure 3-3. Descriptions of all keys begin on the next page. Appendix B has a complete listing of all constructs, their allowed values and their default values.



*Figure 3-3. The 14 Construct keys control features of the Studio Color fixture.*

**Note** The 4 unlabeled keys are not used by the Studio Color LCD controller.

## **Gate Key**

Use this key to open or close the gates (shutters) of selected fixtures, or to select from 60 strobe speeds numbered 0 (slowest) to 59 (fastest).

You can also select from 60 random (arbitrary, unsynchronized) strobe speeds from 0 (slowest) to 59 (fastest). If you have a single fixture selected, the fixture appears to “strobe” at arbitrary rates. If you have multiple fixtures selected, they all “strobe” at individual rates.

3

## **Red, Green and Blue Keys**

The <Red>, <Green> and <Blue> Construct keys are used for color mixing. Also see the description of the <Mode> key on page 3-17 for an explanation of *normal* (gradual) and *double* (“snap” or fast) color mixing.

Select one of these keys, then use the Construct <Up> or <Down> arrow keys to set the amount of this color added to the color mix. Also see the next section.

**Note** The transition time of these constructs are set using the XFade construct as described in the section titled “Xfade Key” on page 3-14.

## **Complementary Colors**

The color mixing system on Studio Color supports millions of colors. This section is not intended to show you how to create all of them, but rather how to derive *complementary colors* from the *primary colors* red, green and blue.

A complementary color is one that appears when none of the primary color is present in the color spectrum (or mix). Red’s complementary color is cyan; the color cyan appears when there is no red in the mix. Green’s complementary color is magenta, and blue’s complementary color is yellow.

Selecting a particular color construct shows you the complementary color for that construct. For example, after selecting the Red construct, the LCD display appears as shown below (FF% means 100%):

```
<-speed xfade delay RED green blue lens1->
RED (-CYAN):255 FF%
P:x
```

The second line of the display, **RED (-CYAN):255 FF%**, indicates the following:

- **RED**: the color construct you selected (the primary color).
- **(-CYAN)**: Red's complementary color (cyan).
- **255 FF%**: the current intensity setting for red (255 = 100% red, or fully saturated with red). **FF%** means 100%.

Table 3-1 shows how to derive the three primary colors (red, green and blue) and their complementary colors (cyan, magenta and yellow) from the color constructs.

*Table 3-1. Primary and Complementary Colors*

Color	Red setting	Green setting	Blue setting
Red	255	0	0
Green	0	255	0
Blue	0	0	255
Cyan	0	255	255
Magenta	255	0	255
Yellow	255	255	0
No color (white)	255	255	255

## Lens 1 Key

See also “Lens 2 Key” on page 3-16. The two Studio Color effects wheels are controlled by the Lens 1 and Lens 2 constructs. Each wheel has four positions (three effects plus open). The three effects positions include beam shaping plus one other effect. Construct values of 0 and 255 select the open position; the other positions are described below.

Lens 1 has the following effects:

- **Beam shaping:** A long, narrow beam rotates into a short, fat beam. Construct values between approximately 100 (39%) and 220 (86%) select beam shaping.
- **Wide angle:** The “effect” position is wide angle, or a large beam diameter with defined edges. Values below approximately 100 (39%) select the wide angle filter.

**Note** The transition time of this construct is set using the XFade construct as described in the section titled “Xfade Key” on page 3-14.

## Flip

The flip feature causes the fixture head to “flip” and the yoke to rotate so the fixture hits the same spot, but with different pan and tilt values. This feature is useful to avoid a stop during beam movement.

A *stop* occurs whenever you try to rotate the yoke more than 370°. The stop is a mechanical device that prevents cables inside the fixture from wrapping too tightly. So the flip in effect “skips” the stop by reorienting the fixture.

To program a flip, first press the Address keys of all the fixtures you want to flip, then press the <Flip> key.

## **MSpeed Key**

(Can be referred to as “motor” or “movement” speed.)

The MSpeed construct determines the total length of time a beam will require to move from one position to another. Two fixtures assigned the same MSpeed value on a page will arrive at their recorded positions (not necessarily *the same* position) at the same time when that page is played back.

When two or more fixtures with the same MSpeed value move, the fixture with the longest distance to travel moves faster than the other fixture(s), but all fixtures on the page arrive at the ending position at the same time.

The Mspeed value can also be linked to the color wheel. This will allow a gradual transition from one color to a different color as the fixture moves from one position to another, rather than a *fast* (immediate) color change at the beginning of the fixture movement. See “CSpeed” on page 3-21 for more information.

You can select a value from 1 (slowest) to 99 (fastest). Table 3-2 shows the relationship between the MSpeed value and the movement time, in seconds.

*Table 3-2. MSpeed Movement Times*

MSpeed Value	Time (sec.)	MSpeed Value	Time (sec.)	MSpeed value	Time (sec.)
99	0.15	66	17.61	33	69.99
98	0.17	65	18.69	32	72.12
97	0.22	64	19.79	31	74.28
96	0.34	63	20.93	30	76.48
95	0.41	62	22.10	29	78.71
94	0.55	61	23.30	28	80.97
93	0.73	60	24.54	27	83.26

*Table 3-2. MSpeed Movement Times*

<b>MSpeed Value</b>	<b>Time (sec.)</b>	<b>MSpeed Value</b>	<b>Time (sec.)</b>	<b>MSpeed value</b>	<b>Time (sec.)</b>
92	0.94	59	25.80	26	85.59
91	1.18	58	27.10	25	87.95
90	1.45	57	28.44	24	90.33
89	1.76	56	29.80	23	92.76
88	2.09	55	31.19	22	95.21
87	2.46	54	32.62	21	97.69
86	2.86	53	34.08	20	100.21
85	3.30	52	35.57	19	102.76
84	3.76	51	37.09	18	105.34
83	4.26	50	38.65	17	107.95
82	4.79	49	40.23	16	110.60
81	5.35	48	41.85	15	113.28
80	5.94	47	43.50	14	115.98
79	6.57	46	45.19	13	118.73
78	7.22	45	46.90	12	121.50
77	7.91	44	48.65	11	124.31
76	8.64	43	50.43	10	127.14
75	9.39	42	52.20	9	130.01
74	10.17	41	54.09	8	132.91
73	10.99	40	55.96	7	135.85
72	11.84	39	57.87	6	138.82
71	12.72	38	59.81	5	141.81
70	13.64	37	61.78	4	144.84

*Table 3-2. MSpeed Movement Times*

MSpeed Value	Time (sec.)	MSpeed Value	Time (sec.)	MSpeed value	Time (sec.)
69	14.58	36	63.78	3	147.90
68	15.56	35	65.82	2	151.00
67	16.57	34	67.89	1	154.13
				0	157.28

## Xfade Key

(Crossfade.) Crossfade affects only the following Studio Color fixture features: Dim, Lens 1, Lens 2 and color mixing.

Xfade is the length of time required for a value change in one of the four Xfade constructs to complete. You can select a value for Xfade from 0.1 second to 99 seconds.

For example, suppose the Dim construct is set to 99 (full bright) on page 1, and 0 (full dark) on page 2. Setting a value of 3.0 seconds for Xfade on page 2 means the fixture will fully dim out in 3.0 seconds when you advance from page 1 to page 2.

Xfade, like the Delay construct, is a page-wide construct; that is, it affects all fixture numbers (fixtures) on any particular page.

**Note** *Loop (sequence) only:* If you want a particular transition to be completed before the next page of a loop (sequence) begins, your selection for Xfade must be less than or equal to your selection for Delay. If Xfade is longer than Delay, the transition will not be completed before the next page begins. See “Delay Key” on page 3-20.

## Dim Key

Use this key to set the beam intensity level for all selected fixture numbers, from 0 (full dark) to 99 (full bright).

**Note** The transition time of this construct is set using the XFade construct.

## Color Key

Use this key to set the following:

- Positions 1 through 6 on the color wheel.
- Forward/reverse wheel spin speeds from 1 (slowest) through 16 (fastest).
- Cycle speeds from 1 (slowest) through 16 (fastest). This option results in smoothly-crossfaded color combinations (never white) using the fixture's subtractive color mixing system. If you have selected multiple fixtures, all color changes are synchronized.
- Random speeds from 1 (slowest) through 16 (fastest). This option results in rapid, "snap" color changes (never white) using the fixture's subtractive color mixing system. If you have selected multiple fixtures, color changes between fixtures are not synchronized.
- Continuously-variable color combinations on the fixed color wheel. You can use the Construct <Up> and <Down> arrow keys to select full positions, half-color combinations and variations in between.

For example, the sample display below selects color wheel position 4 (magenta) because the number **4** is in the center of the displayed numbers:

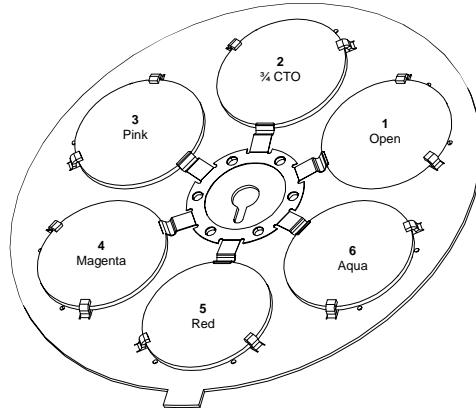
```
gate dim COLOR cspeed cmode position sp->
COLOR: continuous [3/4...4...4/5] P:x
```

The display below selects a color between the half-color combination 2 and 3 (3/4 CTO and Pink) and position 3:

```
gate dim COLOR cspeed cmode position sp->
COLOR: continuous [2...2/3...3..] P:x
```

See also “CSpeed” on page 3-21.

The factory configuration of the color wheel is shown below:



*Figure 3-4. Factory configuration of the Studio Color fixed color wheel.*

## Lens 2 Key

See also “Lens 1 Key” on page 3-11. The two Studio Color effects wheels are controlled by the Lens 1 and Lens 2 constructs. Each wheel has four positions (three effects plus open). The three effects positions include beam shaping plus one other effect. Construct values of 0 and 255 select the open position; the other positions are described below.

Lens 2 has the following effects:

- **Beam shaping:** A long, narrow beam rotates into a short, fat beam. Construct values between approximately 100 (39%) and 220 (86%) select beam shaping. (Values above about 220 or 86% move toward the open position.)
- **Frost:** The “effect” position is frost—soft, undefined beam edges. Values between below approximately 100 (39%) select frost.

**Note** The transition time of this construct is set using the XFade construct as described in the section titled “Xfade Key” on page 3-14.

## Mode Key

Allows you to select color mixing options: *normal* or *double*.

Normal color mixing means the values of the Red, Green or Blue constructs (0—255) correspond directly to the resulting color. Use this choice to achieve gradual color changes with the full spectrum of available colors.

Double color mixing is useful to achieve faster (or *snap*) color changes but limits your available colors. Values of 0—255 for Red, Green or Blue constructs give you two full cycles (from 0% color to 100%) of the selected color. A value of 0 is zero intensity for the color; a value of about 122 (48%) is full intensity, a value of about 140 (55%) is zero intensity and a value of 255 is full intensity.

Follow the procedure below to see how this works:

1. Use the Page<Up> and <Down> arrow keys to select a page that has not been programmed yet.
2. Toggle the <Standby> key until the Standby LED turns OFF.
3. Press the <Select> key and then press the Address keys corresponding to one or more fixtures.

4. Press the <Gate> key and use the Construct <Up> and <Down> arrow keys to select **Open**.
5. Use the joystick to direct the beam at a reference point (wall, screen, or other surface).
6. Press the <Mode> key, then use the Construct <Up> and <Down> arrow keys to select **normal color mixing** as shown below:



```
gate dim color cspeed CMODE position sp->
    MODE: normal color mixing           P:x
```

7. Press the <Green> key and use the Construct <Up> and <Down> arrow keys to select a value of **0**.
8. Press the <Blue> key and use the Construct <Up> and <Down> arrow keys to select a value of **0**.
9. The result is a 100% red beam. Press the <Red> key and use the Construct <Up> and <Down> arrow keys to vary the value of the construct from 0 to 255. You should see a red beam of varying intensities.
10. Press the <Mode> key and use the Construct <Up> and <Down> arrow keys to select **double color mixing**.
11. Press the <Red> key and use the Construct <Up> and <Down> arrow keys to vary the value of the construct.
  - From 0 to about 122 (48%), the beam rapidly increases in intensity.
  - The beam reaches a minimum intensity at about 140 (55%).
  - From about 141 (55%) to 255 (FF%), the beam rapidly increases in intensity again.
12. With the Red construct at full intensity, try varying the Green and Blue constructs to see the effect on color mixing.

## **Position Key (POS)**

Use this key to select one of 99 user-programmable position presets. (You do not need to press this key if you want to manually position the beam as described below.)

### **Manual vs. Preset Positioning**

There are two ways to position the beam: manually using the joystick or automatically using preset positioning. Preset positioning allows you to store pan/tilt values in the pages of memory 9 for instant positioning.

3

**Manual positioning:** If you are programming a very simple show which uses a small number of fixtures and beam position is not expected to change with time (such as a nightclub), you can use *manual positioning*. Manual positioning consists of manually moving the beam with the joystick and recording the position as part of the page. Although slightly simpler than preset positioning, setting a beam position manually makes the position more difficult to change later because you would have to edit every page containing the old position.

**Preset positioning:** If you are programming a more complex show in which beam positioning is critical and can change with time (such as a touring act), you should use *preset positioning*. With preset positioning, you move the beam to the desired location with the joystick and assign that position to a page in memory 9 (from 1 to 99). You then recall the same position preset by pressing the <POS> key and advancing to the page number containing the preset position you wish to use.

The advantage of preset positioning over manual positioning is that you can change your position presets when the beam position changes, and all pages using that preset are automatically updated.

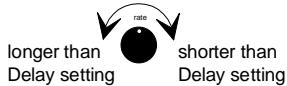
**Note** The full set of 99 position presets is available for all fixtures connected to the controller. For example,

suppose you have programmed all 99 pages of memory 9 as position presets. All 99 position presets are available for fixture number 1, all 99 position presets are available for fixture number 2, etc.

## ***Delay Key***

Use this key to set the amount of time you want the controller to pause on the current page in the loop before advancing to the next page in the loop. You can select from 0 seconds to 99 seconds, or you can select **Hold** which will hold on the page indefinitely until you manually advance (press the Page <Up> arrow key to advance). **Hold** is between the settings of 0 and 99.

The advance rate set by the <Rate> knob changes the delay time. Turning the <Rate> knob clockwise subtracts from the Delay setting; turning the <Rate> knob counter-clockwise adds to the Delay setting.



**Note** If the controller is using audio advance, the Delay and Rate settings are ignored.

For more information about the <Rate> knob, see the section titled “Setting Rate and Delay Time” on page 4-18.

## **CSpeed**

*This option is accessible only through the menus.* For more information on accessing menus, see the section titled “Setting CSpeed” on page 3-21.

(Color change speed.) This option determines how fixed color wheel changes occur: at the fastest possible speed (at the beginning of beam movement), or at the speed set by the MSpeed construct (the color change completes at the same time as the beam reaches its destination).

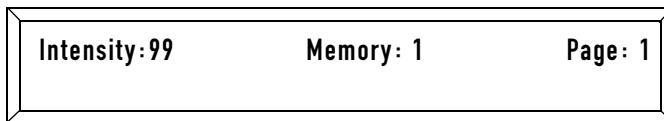
3

You can select either **Fast color change** (default; change occurs as quickly as possible) or **Mspeed color change** (change occurs smoothly over the MSpeed time value).

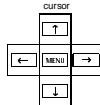
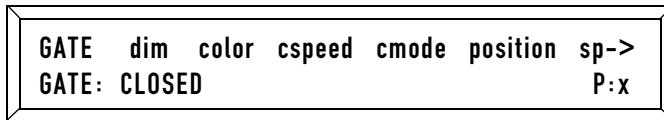
## **Setting CSpeed**

You must set the parameters for the CSpeed construct using the controller’s menu system, not using the Construct keys.

1. Toggle the <Menu> key until the LCD display appears similar to the one shown below:



2. Press the <Select> key, then press the numbered Address keys corresponding to all fixtures you wish to program. The LCD display then appears similar to the one shown below:



3. Select **Cspeed** using the Cursor <Left> and <Right> arrow keys located on either side of the <Menu> key.

4. You have the options shown below:

```
gate dim color CSPEED cmode position sp->
CSPEED: fast color change P:x
```

You can select either **Fast color change** (default; change occurs as quickly as possible) or **Mspeed color change** (change occurs smoothly over the MSpeed time value).

Use the Construct <Up> and <Down> arrow keys to select an option, then press the <Record> key to save your selection for the fixture number(es).

# **Chapter 4**

# **Basic Programming**

**4**

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# **Programming Overview**

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The Studio Color LCD controller has 9 separate memories, each containing 99 pages, for a total of 891 pages of program storage.

You can think of the controller's memory as being like a book. The book has 9 chapters (memories) and each chapter has 99 pages.

## ***Page, Construct, Parameter, Loop***

Each *page* (which can also be called a *look* or a *scene*) stores a unique combination of *constructs* (fixture features) and their *parameters* (values) which together form a particular look or effect. You can link pages together to form a *loop* (also called a *chase*, a repeating series of pages).

## ***Address and Preset Mode***



The controller has two fundamental modes of operation: *Address mode* (also called *Edit mode*) and *Preset mode* (also called *Playback mode*). The current state of the controller is indicated by which LED on the <Address>/<Preset> key is ON.



**Address (Edit) Mode:** (Address LED is ON.) In Address mode you program one or more fixtures. Each program is stored as one page (a page consists of a set of constructs and their values); the page resides in one of the nine memories. You can play back the program by manually selecting the memory and page you assigned it to, or automatically using the <Auto> (auto advance) key.

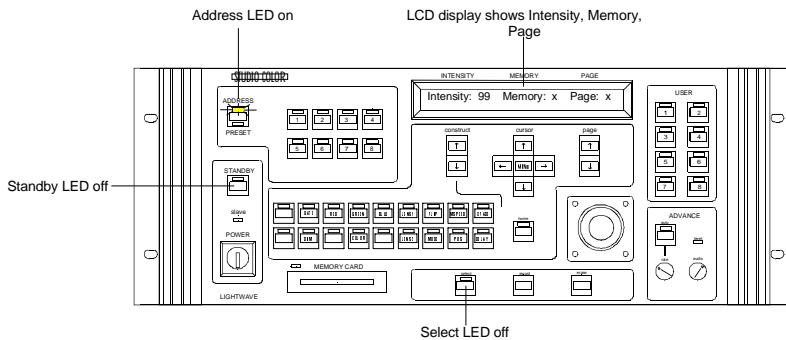


**Preset (Playback) Mode:** (Preset LED is ON.) In Preset mode you take a program you created in address mode and assign it to one of the 1024 presets (eight presets in each of 128 preset banks). A preset can be either a single page (scene) or a loop (repeating sequence of pages).

# ***Preparing to Program***

---

Before beginning any programming, make sure the controller appears as shown below:



4

*Figure 4-1. Before programming, make sure the controller's Address LED is ON, the Select and Standby LEDs are both OFF, and the controller is displaying the Intensity, Memory and Page.*

Toggle the <Standby> key until the Standby LED turns OFF.

Toggle the <Address> key until the Address LED turns ON.

Toggle the <Menu> key until Intensity, Memory and Page is showing in the LCD display.

Toggle the <Select> key until the Select LED turns OFF.

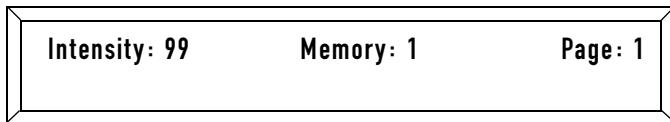
# ***Programming Guided Tour***

---

This section leads you step-by-step through creating a simple four-page program, playing back the program page-by-page, creating a loop and recording a preset. Only one fixture is required, although you can use more than one if you wish.

## ***Recording Page 1***

1. Configure the controller and connect fixtures as described in Chapters 1 and 2. Power ON fixtures then power ON the controller if you have not already done so. Make sure the controller appears as shown in Figure 4-1 on page 4-3.
2. Set the controller on memory 1, page 1 using the Cursor and Page <Up> and <Down> arrow keys, respectively. The LCD display below shows a controller set for memory 1, page 1:



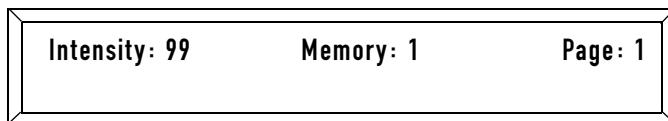
3. Press the <Select> key; it flashes.
4. Press the <Address> keys of the fixtures you want to program. For example, if you have one fixture set to fixture number 1, press the <1> key. To select a range of fixtures, press and hold the starting fixture number key then press the ending fixture number key.
5. Press the <Gate> key, then use the Construct <Up> and <Down> arrow keys to select **Open**.
6. Press the <Color> key, then use the Construct <Up> and <Down> arrow keys to select a color (not the open, or white, position). Notice that the selected fixtures display the color you selected.
7. Press the <Delay> key, then use the Construct <Up> and <Down> arrow keys to select a value of **2.0 seconds**.
8. Use the joystick to position the beam to any location.

9. Press the <Record> key to save page 1. Notice that the Address LEDs of all fixture numbers you selected are now ON. This is because the shutters of these fixtures are open (you selected **Open** for the Gate construct in Step 5.)

## **Recording Page 2**

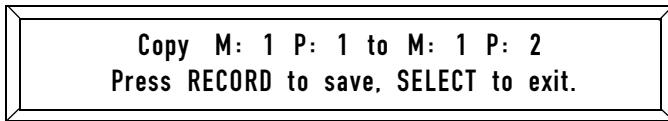
You will create pages 2—4 of the sample program using the controller's page copy feature, which copies constructs and parameters from one page to another.

1. After recording page 1, the LCD display appears as shown below:



4

2. Press the <Select> key; it flashes.
3. Press the Page <Up> arrow key to select page 2. The LCD display then appears as shown below:



4. Press <Record> to complete the page copy.
5. The controller is now set for memory 1, page 2. Press the <Select> key; it flashes.
6. Press the <Address> keys of the fixtures you want to program.
7. Press the <Gate> key; notice it is already set to **Open**; in fact, all construct parameters are now identical for those fixture numbers on pages 1 and 2. This is the result of the page copy.
8. Press the <Color> key then use the Construct <Up> and <Down> arrow keys to select a different color, or spin speed.
9. Press the <Delay> key and use the Construct <Up> and <Down> arrow keys to select a value of **0.0 seconds**.

10. Use the joystick to position the beam in a different place of your choosing.
11. Press the <Record> key to save page 2.

## ***Recording Page 3***

1. Press the <Select> key; it flashes.
2. Press the Page <Up> arrow key to select page 3.
3. Press <Record> to complete the page copy.
4. The controller is now set for memory 1, page 3. Press the <Select> key; it flashes.
5. Press the <Address> keys of the fixtures you want to program.
6. Press the <Gate> key, then use the Construct <Up> and <Down> arrow keys to select **Open**.
7. Press the <Color> key and select a different color of your choice.
8. Use the joystick to position the beam in a different place of your choosing.
9. Press the <Record> key to save page 3.

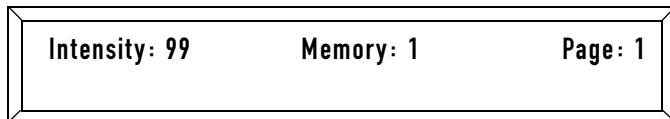
## ***Recording Page 4***

Use the same procedure as for recording page 3, making sure you do all of the following:

1. Select a value of **5.0 seconds** for the Delay construct.
2. Position the beam in a different place than in page 3.
3. Press <Record> when you're finished.

## **Manually Playing Back Pages 1 Through 4**

1. Use the Page <Up> and <Down> arrow keys to select page 1, as shown below:



2. The fixture(s) programmed for page 1 should now display the color and position you selected for them.
3. Press the Page <Up> arrow key to select page 2. The fixture(s) programmed for page 2 should now display the color and position you selected for them. Do the same for pages 3 and 4.

**4**

## **Review**

You have now created and manually played back a simple four-page program. The next sections show you how to create a loop out of those four pages and then how to record that loop or any of the pages in the loop as a preset.

## ***Creating a Loop***

A *loop* is a sequence of consecutive pages that continually plays back until you stop it.

Normally, you create a loop by bracketing the pages on either side of the loop by un-initialized pages; however, since the first page in this sample loop is page 1, only one un-initialized page is required.

1. Use the Page <Up> and <Down> arrow keys to select memory 1, page 5.
2. Press the <Select> key; it flashes.

3. Press the <Erase> key. The LCD display appears as shown below:

**Press ERASE to un-initialize M: 1 P: 5  
or press SELECT to exit.**

4. Press the <Erase> key to un-initialize page 5.
5. Use the Page <Down> key to select page 1.
6. Press the <Auto> key, located to the right of the joystick.
7. The pages in the loop begin playing back as you recorded them. The length of time each page “plays” is set by the Delay construct. Page 1 “plays” for 2 seconds, pages 2 and 3 advance quickly because they are set for 0 seconds, and page 4 “plays” for 5 seconds.
8. Turn the <Rate> knob (located under the <Auto> key) all the way clockwise. This speeds up playback, shortening the time between pages. In fact, you might not even see pages 2 and 3 because their delay times were set to zero.
9. Then turn the <Rate> knob all the way counter-clockwise, slowing down playback, increasing the time between pages.

## ***Recording a Preset***

You can record either the entire loop or any page within the loop as a preset for one-touch playback later.

- If you want to record the entire loop as a preset, start the loop running as described in the previous section.
  - If you want to record a single page as a preset, press the <Auto> key to turn OFF the Auto LED, then select the page using the Page <Up> and <Down> arrow keys.
1. Toggle the <Address>/<Preset> key until the Preset LED is ON.
  2. Press the <Select> key; it flashes.

3. Press the numbered Preset key where you want to record the preset. For example, to record preset number 1, press the <1> key.

**Note** The Studio Color LCD controller supports up to 1024 presets from the front panel through the use of *preset banking*. In this simple procedure you do not need to use it, but if you would like to learn more, see the section titled “Preset Programming” on page 4-19.

4. Press <Record>. You are finished recording the preset. See the section titled “Preset Playback” on page 4-23 for details about preset playback.

*Steps 5—7 demonstrate the loop as a preset.*

4

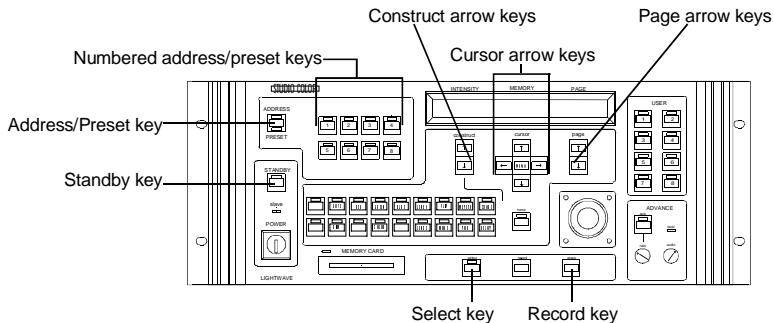
5. Press the <Auto> key to turn OFF the Auto LED.
6. Press the Preset key of any preset you have *not* recorded yet. All Preset LEDs should now be OFF. The page that was active in Step 5 should still be playing back.
7. Press the key of the preset you recorded in this section. Its Preset LED comes ON, the Auto LED also comes ON and your loop starts playing back.

# ***Creating a Program***

---

This section gives you detailed step-by-step instructions for creating a program. For a quick step-by-step overview, see the section titled “Programming Guided Tour” on page 4-4.

Figure 4-2 below shows the programming keys that will be referenced in this section.



*Figure 4-2. Programming keys.*

## ***The Six Basic Steps***

The programming process can be broken down into the six steps listed below. Refer to the section titled “Using the Construct Keys” on page 3-8 and to Figure 4-2 for information not covered in this section.

### ***Step 1: Make Sure the Controller is Ready for Programming***

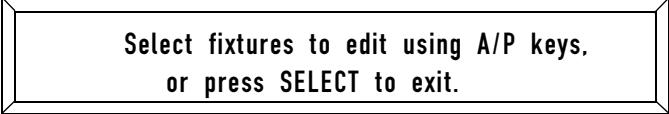
Figure 4-1 on page 4-3 shows how the controller looks when it is ready for programming.

### ***Step 2: Select the Memory and Page***

Use the Cursor <Up> and <Down> arrow keys to select a memory. If this is your first program, use memory 1.

## Step 3: Press the Select Key

Press the <Select> key to begin programming. The Select LED flashes and the LCD display appears as shown below:



Select fixtures to edit using A/P keys,  
or press SELECT to exit.

## Step 4: Select Fixture Number

Press the Address keys corresponding to all fixture numbers you wish to program. You can do the following:

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- Press one Address key to program a single fixture.
- Press and hold two Address keys at the same time to select a range of fixtures. For example, holding down Address keys <1> and <4> at the same time selects fixture numbers 1 through 4.
- Press multiple Address keys, one at a time, to select multiple fixtures. For example, pressing the <2>, <7> and <5> keys to program fixture numbers 2, 7 and 5 (the order is not important).

**Note** Selecting multiple fixture numbers means all fixtures will share the same constructs and values. However, random (unsynchronized) constructs will still play back randomly. See the section titled “Programming Hints” on page 3-2 for more information.

## Step 5: Edit Constructs

Press one of the Construct keys to edit that construct. By default, with no constructs programmed, the gate (shutter) is closed so no light is emitted. Opening the shutter without changing any other constructs projects a white beam at maximum brightness. As you edit constructs, you will see first-hand what your page looks like.

For detailed descriptions of all constructs, see the section titled “Using the Construct Keys” on page 3-8.

## **Step 6: Press the Record Key**

When you are finished editing constructs, press the <Record> key to save your page.

**Note** After recording the page, the address LEDs of all fixture numbers with the Gate construct set to **Open** come ON. If the Gate construct is set to **Closed**, the address LED will not be on, regardless of the other construct parameter values.

## **Where To Go From Here**

After programming your first page, you can do the following:

- **Program additional pages the same way.** Be sure to select an unprogrammed page first.
- **Create a loop:** A loop is a sequence of pages that runs continuously until you stop it. Pages you wish to run as a loop must be a contiguous block in the same memory (for example, memory 1, pages 1—10). For more information, see the section titled “Creating a Loop” on page 4-14.
- **Page copy:** Copy entire pages from one location in memory to another. This can save you time if you want to create pages with slight variations, such as movement or color changes. For more information, see the section titled “Page Copy” on page 4-13.
- **Block copy and reverse block copy:** Similar to page copy, block copy allows you to copy ranges of pages from one location to another. Reverse block copy copies the pages in the reverse order. For more information, see the section titled “Block Copy (and Reverse)” on page 4-16.
- **Preset programming:** By assigning a page or a loop to one of the numbered Preset keys, you can recall (play back) the page or loop at any time at the push of a button, or remotely using an analog controller as described in Chapter 6. For more information, see the section titled “Preset Programming” on page 4-19.

# **Page Copy**

---

Use page copy to copy the entire contents of a programmed page to any other page in any other memory. This is useful for creating additional pages that contain only slight changes, such as movement changes or single-parameter changes.

Before continuing, make sure your controller is ready for programming as shown in Figure 4-1 on page 4-3. Also, make sure you have programmed at least one page.

1. Select the page (source) that you want to copy from using the Page <Up> and <Down> arrow keys.

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2. Press the <Select> key. The LCD display appears as shown below:

Select fixtures to edit using A/P keys,  
or press SELECT to exit.

3. Select the destination memory and page you want to copy the contents of the current page to:

- Press the Cursor <Up> and <Down> arrow keys to change the memory number.
- Press the Page <Up> and <Down> arrow keys to change the page number.

When you press the Cursor or Page key for the first time, the LCD display appears similar to the one shown below:

Copy M: 1 P: 5 to M: 2 P: 1  
Press RECORD to save, SELECT to exit.

The LCD display above would copy the contents of memory 1, page 5 to memory 2, page 1.

4. Press the <Record> key to complete the page copy.

# ***Creating a Loop***

---

A *loop* is a sequence of pages that repeats continuously until you stop it. You can vary the rate of playback using the <Rate> knob.

You must perform the two basic steps shown below:

**Step 1.** Record the pages as a contiguous block in the same memory. For example, memory 1, pages 1—10.

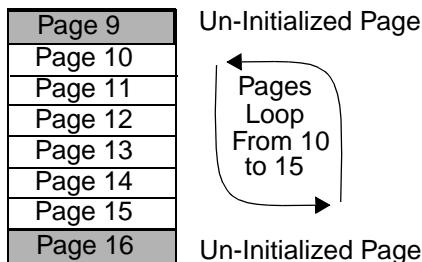
**Step 2.** Designate un-initialized pages that “bracket” (one before and one after) the pages in the loop.

## ***Step 1: Record the Pages***

Recording pages was covered previously in the section titled “Creating a Program” on page 4-10. When you are recording a loop, all pages must be contiguous in the same memory (for example, memory 1, pages 1—10).

## ***Step 2: Record Un-Initialized Pages***

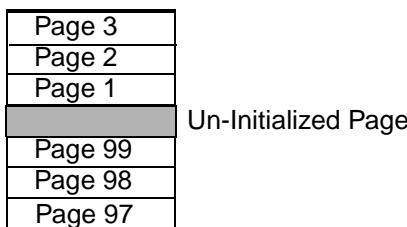
An *un-initialized page* acts as a “placeholder” to indicate the beginning and end of your loop. Normally, you must create two un-initialized pages (one before the first page of your loop, one after the last page of your loop). See Figure 4-3.



*Figure 4-3. The pages you wish to play as a loop are bracketed on either side by un-initialized pages.*

You can record over an un-initialized page with a programmed page at any time.

**Note** The controller automatically places an un-initialized “page” between pages 99 and 1, as shown in Figure 4-4. So if the first page of your loop is page 1, you need to create one un-initialized page after the last page of your loop. If the last page of your loop is page 99, you need to create one un-initialized page before the first page of your loop.



*Figure 4-4. The controller automatically places an “un-initialized” page before page 1 and after page 99.*

1. Select the first or beginning page that you want to “un-initialize.” This un-initialized page should be the page before the first page of your loop (unless the first page of your loop is page 1, in which case a beginning un-initialized page is not needed).
  - Use the Page <Up> and <Down> arrow keys to select the page.
  - Use the Cursor <Up> and <Down> arrow keys to select the memory.
2. Press the <Select> key. The Select LED flashes. *Disregard the message on the LCD display.*

3. Press the <Erase> key. The LCD display appears as shown below:

Press ERASE to un-initialize M: x P: x  
or press SELECT to exit.

4. Press the <Erase> key again to un-initialize the page.
5. Repeat steps 1 to 4 for the second or ending un-initialized page. (If the last page of your loop is 99, an ending page is not needed.)

## ***Block Copy (and Reverse)***

---

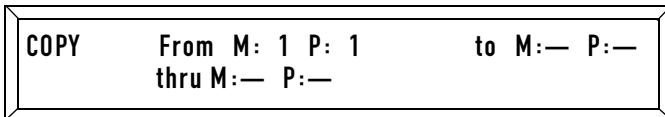
Before continuing, make sure your controller is ready for programming as shown in Figure 4-1 on page 4-3.

Use *block copy* to copy an entire range (*block*) of consecutive pages from one location in memory to another (for example, you can copy memory 1, pages 1—10 to memory 2, pages 9—18). This function can save time in programs that have multiple repeating pages with slight parameter changes each time the loop repeats. *Reverse block copy* is an option that reverses the order of the pages you are copying.

1. Use the Page <Up> and <Down> arrow keys to select any page within the block of pages that you want to copy.
2. Press the <Select> key. The LCD display appears as shown below:

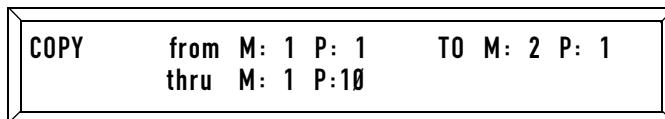
Select fixtures to edit using A/P keys.  
or press SELECT to exit.

3. Press the <Auto> key, located to the right of the joystick. The LCD display then appears similar to the one shown below:



4. Select the memory and first page of the block of pages you want to copy from.
  - Press the Cursor <Up> and <Down> arrow keys to change the memory number.
  - Press the Page <Up> and <Down> arrow keys to change the page number.
5. Press the <Auto> key. Select the last page of the block of pages you want to copy from using the Page <Up> and <Down> arrow keys.
6. Press the <Auto> key. Select the first page of the destination block of pages you wish to copy to.

For example, the LCD display below indicates that memory 1 pages 1—10 will be copied to memory 2, pages 1—10.



7. *Optional: Reverse block copy.* Press the Construct <Up> or <Down> arrow keys to toggle between **Copy** and **Copy Reverse**. Copy Reverse reverses the order of pages that you are copying.
8. Press the <Record> key. After a few seconds, the Select LED turns OFF, indicating you are finished.

# **Setting Rate and Delay Time**

---

Before continuing, make sure the controller is ready for programming as shown in Figure 4-1 on page 4-3.

You can control the speed of your loop using the <Rate> knob and the Delay construct. The Delay construct (also called *delay time*) determines how long each page in the loop “plays” before moving on to the next page, and the <Rate> knob lengthens or shortens the delay time.

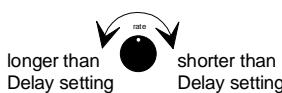
**Note** The Rate and Delay settings are ignored if you are using audio advance as described in the section titled “Audio Input Playback” on page 6-27.

Using the <Rate> knob to control playback is referred to throughout this manual as *auto advance*.

## **Playing Back the Loop**

1. Use the Page <Up> and <Down> arrow keys to select a page in the loop that you wish to begin with. (If you want the loop to initially run from the first page on, select the first page; if you want the loop to run from the third page on, select the third page, and so on.)
2. Press the <Auto> key located over the <Rate> knob. The Auto LED comes ON and the loop runs beginning from the page you selected.

## **Varying the Playback Rate**



While the loop is running, turn the <Rate> knob clockwise to run the loop faster or counterclockwise to run the loop slower.

## Varying the Delay Time

The Delay (time) construct sets the amount of time you want the controller to pause on the current page before advancing to the next page. Turning the <Rate> knob clockwise *subtracts from* the delay time; turning the <Rate> knob counter-clockwise *adds to* the delay time.

**Note** Audio advance causes the controller to ignore the Delay and Rate settings. For more information, see the section titled “Audio Input Playback” on page 6-27.

Now see one or more of the following sections:

4

- **Detailed description of the Delay construct:** “Delay Key” on page 3-20.
- **Quick overview of programming (including using the Delay construct):** “Programming Guided Tour” on page 4-4.
- **Detailed explanation of programming:** “Creating a Program” on page 4-10.

## Preset Programming

---

A *preset* can be a single page or a loop of pages assigned to one of the Preset keys. Pressing one of the Preset keys plays back your page(s) exactly as you recorded them.

The controller supports up to 1024 presets from the front panel through the use of *preset banking*. However, you can also play back presets remotely in the following ways (see Chapter 6 for more information):

- up to 96 presets using 12-level preset access
- up to 1023 presets using binary preset access

**Notes** (1) Audio advance is independent of the presets. For more information about audio triggering, see the section titled “Audio Input Playback” on page 6-27.

(2) To prevent inadvertent erasure of presets, you cannot directly erase pages used as presets. You record over existing presets to change them.

(3) If you wish to erase a preset, you can do one of two things: record another preset in its place, or erase all memories, pages and presets as described in the section titled “Erasing All Memory” on page 5-14.

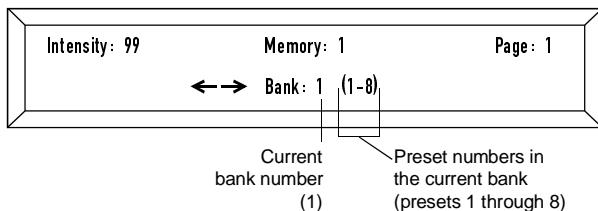
## Using Preset Banking

*Preset banking* allows you to access up to 1024 presets from the controller’s front panel. The controller has 128 banks of presets; each of the 8 Preset keys can be used as a separate preset in each bank for a total of 1024 presets.



Toggle the <Address>/<Preset> key until the Preset LED comes ON.

Preset bank 1 contains presets 1 through 8, which directly correspond to the Preset keys. Preset bank 2 contains presets 9 through 16 (the Preset <1> key corresponds to preset 9, the Preset <2> key corresponds to preset 10, and so on). See Figure 4-5.

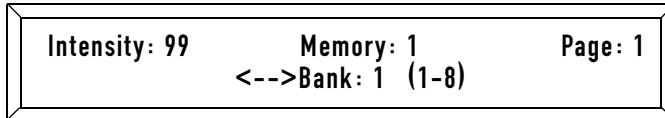


*Figure 4-5. The preset banking display shows the current preset bank number and the preset numbers within that bank.*

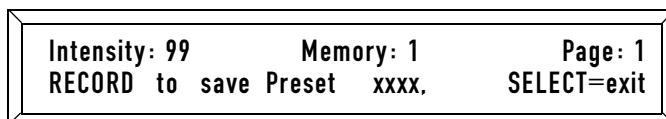
## Recording a One-Page Preset



1. Use the Construct and Page <Up> and <Down> arrow keys to select the memory and page you want to record as a preset.
2. Toggle the <Address>/<Preset> key until the Preset LED turns ON. The LCD display then appears as shown below:



3. Use the Cursor <Right> and <Left> arrow keys to select a bank of presets. Each bank contains 8 presets.
4. After you have selected a preset bank, press the <Select> key.
5. Press the numbered Preset key (<1> to <8>) where you want to store the preset. See Figure 4-5 on page 4-20 for an explanation of how preset bank numbering works.
6. *Optional.* If you are using 12-level preset access, follow the instructions in the section titled “Using Twelve-Level Preset Access” on page 6-19.
7. Press the <Record> key. You are then prompted to confirm your choice of a preset as shown below:



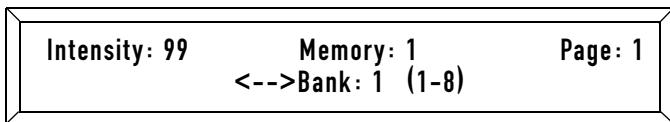
8. Press the <Record> key again to confirm or press the <Select> key to quit without storing the preset.
9. You can now recall this preset by selecting the preset bank and pressing the Preset key you recorded in Step 7. See the section titled “Preset Playback” on page 4-23.

4

## Recording a Loop as a Preset

Start the loop running, then assign the entire loop to one of the Preset keys. For more information about loops, see the section titled “Creating a Loop” on page 4-14.

1. Use the Page <Up> and <Down> arrow keys to select any page within the loop that you want to record as a preset.
2. Toggle the <Address>/<Preset> key until the Address LED is ON.
3. Press the <Auto> key. The pages start advancing, playing back the loop at the rate set by the <Rate> knob and the Delay construct.
4. Toggle the <Address>/<Preset> key until the Preset LED is ON. The LCD display then appears as shown below:



5. Use the Cursor <Right> and <Left> arrow keys to select a bank of presets. Each bank contains 8 presets.
6. Press the <Select> key. The Select LED flashes and the LCD display appears as shown below:



7. Press the Preset key (<1> to <8>) on the front panel to store the loop. See Figure 4-5 on page 4-20 for an explanation of how preset bank numbering works.
8. *Optional.* If you are using 12-level preset access, follow the instructions in the section titled “Using Twelve-Level Preset Access” on page 6-19.
9. Adjust the following settings; these settings are recorded as part of the preset (you can change them later).

- Advance settings:
    - Random, Audio 1, Audio 2: see “Audio Input Playback” on page 6-27.
    - Auto: see “Setting Rate and Delay Time” on page 4-18.
  - Effects settings: Color modulate and Intensity (dim) modulate. See “Audio Input Playback” on page 6-27.
10. Press the <Record> key. You are now finished.

## **Preset Playback**

**4**

You can play back presets in the following ways:

- **Pressing one of the numbered Preset keys on the controller’s front panel.** Toggle the <Address>/<Preset> key on the controller’s front panel until the Preset LED is ON. Then select a preset bank using the Cursor <Right> and <Left> arrow keys and press one of the numbered Preset keys to select a preset within the bank. This instantly plays back the preset. The preset continues to play back indefinitely until you select another preset.
- **Using 12-level preset access.** This method allows to you record and play back up to 96 presets using a remote analog 0-10V controller. For more information, see the section titled “Using Twelve-Level Preset Access” on page 6-19.
- **Using binary preset access.** This method allows to you record and play back up to 1023 presets using a remote analog 0-10V controller. For more information, see the section titled “Using Binary Preset Access” on page 6-21.

## ***Things to Remember***

- To change to another preset at any time, switch to the bank containing the preset and press the corresponding Preset key.
- If a preset is playing back a loop, you can quit playback by pressing the <Auto> key until the Auto LED turns OFF. The currently-running preset stops at the page that is active when you press the <Address>/<Preset> key.
- The way that master intensity and sequencing (auto advance, audio 1 advance, audio 2 advance) are implemented depends on your choice for dependent/independent presets as described in “Switch B-6: Dependent/Independent Presets” on page 2-7.
- The following settings can be manually overridden during preset playback (see Chapter 6 for more information):  
Random playback, Audio1 (audio playback), Audio2 (audio playback), Auto playback, Color modulate, Intensity (dim) modulate



# ***Viewing and Editing Programs***

---

Once your pages are programmed, you can view or edit the pages you programmed and change any constructs or parameters you wish. Use the same procedure you used to record the pages, making sure you press <Record> when you are finished editing.

See the section titled “Creating a Program” on page 4-10.

## ***Viewing Fixtures***

---

**4**

You can quickly view the current constructs and parameters of a particular fixture number by pressing and holding the Address key.

1. Make sure the controller is ready for programming as shown in Figure 4-1 on page 4-3.
2. Use the Cursor and Page <Up> and <Down> arrow keys, respectively, to select a memory and page. The Address LEDs of all fixtures on that page programmed with their gates (shutters) open come ON.
3. Press and hold the Address key of the fixture number you wish to view.



**Caution** **Holding down an Address key for longer than about 10 seconds at a time locks that fixture out of the page. To unlock the fixture, release the key then hold it in again until the fixture unlocks.**

4. A summary of all constructs and parameters for that fixture number appears, similar to the one shown below:

Dim	Col	Rd-Gr-Bl	L1-L2	Sp	Po	Xfd	Dly	Pag
99	1	FF-FF-FF	0-0	99	JS	0.1	0.0	1

Most fields are self-explanatory; below is a brief description of some of the fields:

- **Sp:** Displays the MSpeed setting.
- **Po:** (Beam position.) **JS**, as shown above, indicates the beam has been positioned manually using the joystick. A value from 1 to 99 appears if a position preset is used instead. See the section titled “Using Position Presets” on page 6-3 for more information about using position presets.
- The following constructs are displayed in percentages (0—FF) rather than numerical values (0—255): **Rd-Gr-Bl** (Red-Green-Blue); and **L1-L2** (Lens 1, Lens 2).

All of the possible values that can be displayed for the **Col** (Color) construct are listed in Appendix B.

# **Erasing Pages**

---

You may want to erase a page when there are undesirable or old pages in memory. It is often best to clear out these pages to prevent confusion in future programming. Note the following:

- Instead of erasing the page, you could always record another page in its place.
  - Erasing a page causes that page to become a “blackout” page (the Gate construct is set to “Closed”, so all fixtures go dark).
  - An erased page is still an initialized page.
1. Select the memory and page you wish to erase using the Cursor and Page <Up> and <Down> arrow keys.
2. Press the <Select> key. The LCD display appears as shown below:
- Select fixtures to edit using A/P keys,  
or press SELECT to exit.
3. Press the <Erase> key. The LCD display appears similar to the one shown below:
- Press ERASE to un-initialize M: x P: x  
or press SELECT to exit.
4. ***Do not press the ERASE key again as stated in the LCD display; instead, press the <Record> key. The LCD display briefly displays: Recording.***

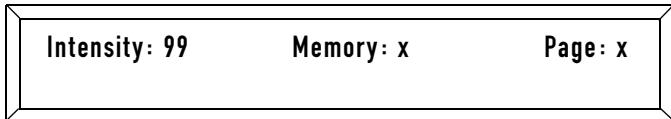
**4**

**Note** If you press the <Erase> key a second time you create an un-initialized page rather than an erased or blackout page. To re-initialize the page, record a programmed page in its place.

# **Master Dim**

---

The sample LCD display below shows a value of **99** for Intensity (also called *master dim*). The value of 99 is maximum intensity (full bright) and 0 is the minimum intensity (full dim).



You can change the intensity setting using the Construct <Up> and <Down> arrow keys. Master dim can also be controlled in the following ways:

- By a submaster as described in the section titled “Submasters” on page 6-23. Also see the section titled “Switch B-6: Dependent/Independent Presets” on page 2-7.
- By a master controller as described in the section titled “Switch B-6: Dependent/Independent Presets” on page 2-7.
- Using channels 11 or 12 in binary preset access as described in the section titled “Using Binary Preset Access” on page 6-21.
- By Lightwave Control Center software. More information about Lightwave Control Center is shown in the section titled “Lightwave Control Center” on page 6-31.

# Homing Fixtures

---

Homing a fixture causes its shutter to close, its lamp to strike (if off), and for all wheels and motors to return to their home (default) positions.

1. At any time, press the <Home> key on the controller's front panel. The <Home> LED flashes.
2. While the <Home> LED is flashing, press the Address key(s) corresponding to the fixture(s) you want to home.
3. The Home and selected Address LEDs now flash for another 10 seconds and the fixtures perform their homing operations.

4

**Note** Pressing <Home> after selecting the fixture numbers allows you to continue programming or playing back while the fixtures are homing.

4. The Address LEDs turn OFF when homing is finished.
5. After homing, the fixture waits for its next command. If a fixture fails to home, refer to the *Studio Color User Manual* for troubleshooting suggestions.
6. Once homed, the fixtures join the sequence running (if any).



# *Chapter 5*

## *Using the Menus*

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# Overview

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Figure 5-1 shows an overall view of the menu system:

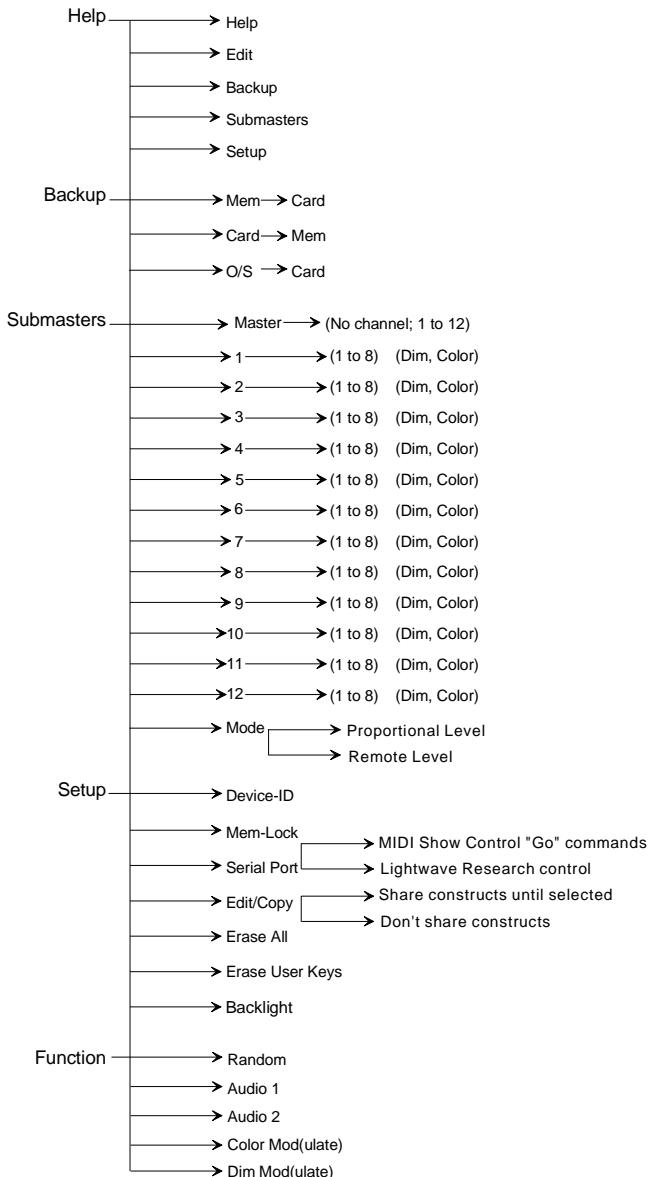


Figure 5-1. The Studio Color LCD controller's menu system.

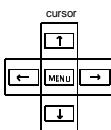
- **Help:** On-screen help for all Main menu options.
- **Backup:** Options for transferring controller memory to and from a RAM card and for backing up the controller's operating system to a RAM card. See Chapter 7.
- **Submasters:** Allow you to change color and dim constructs remotely using a 0—10V analog controller. See the section titled "Submasters" on page 6-23.
- **Setup:** Set the following options:
  - **Device-ID:** Select the controller's Device ID. See the section titled "Selecting MSC or LSC" on page 5-8.
  - **Mem-Lock:** Lock out memories to prevent accidental reprogramming. See the section titled "Locking/Unlocking Memory" on page 5-12.
  - **Serial Port:** Set up the RS-232C serial communication port for use with Lightwave Control Center (LCC). See the section titled "Selecting MSC or LSC" on page 5-8 and "Lightwave Control Center" on page 6-31.
  - **Edit/Copy:** Determines how the fixture (address) parameter copy command works. See the section titled "Address Parameter Copy" on page 6-5.
  - **Erase All:** Quickly erase all memories, pages and presets (except for locked memories). See the section titled "Erasing All Memory" on page 5-14.
  - **Erase User (keys):** Quickly erase any custom definitions of the User keys and return them to their default definitions. See the section titled "Erasing All User Keys" on page 6-14.
- **Function:** Enables or disables the following advanced programming functions (advanced programming is covered in Chapter 6):
  - Random advance
  - Audio 1 advance, Audio 2 advance
  - Color modulate
  - Dim modulate

# ***Navigating the Menus***

---

This section explains how to use the menu system. More information is contained in subsequent sections in this chapter.

## ***Summary***

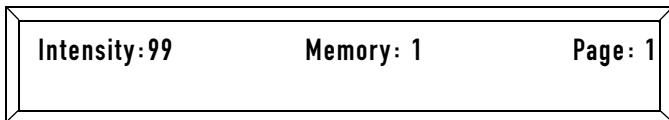
- Press the <Menu> key to enter and exit the menu system. If you're in the menu system, pressing the <Menu> key takes you completely out of the menu system, no matter where you are, saving the options you selected.  


The diagram shows a 2x3 grid of buttons. The top row contains a left arrow, a central 'MENU' button, and a right arrow. The bottom row contains an up arrow, a down arrow, and a center button. The word 'cursor' is written above the top-left button.
- Press the Cursor <Up> and <Down> arrow keys to move up and down through the menu system one level at a time.
- Use the Cursor <Right> and <Left> arrow keys to move between menu options.
- Typically, you use the Construct <Up> and <Down> arrow keys to change parameter values; a message appears in the LCD display telling you if another key is required.  


The diagram shows a 2x2 grid of buttons. The top row contains an up arrow and a right arrow. The bottom row contains a down arrow and a left arrow. The word 'construct' is written above the top-left button.
- You also use the Construct <Up> and <Down> arrow keys to scroll through pages on multi-page screens.

## ***Getting Started***

Upon powering up the controller, after its power-on self-test successfully completes, the LCD display appears as shown below:

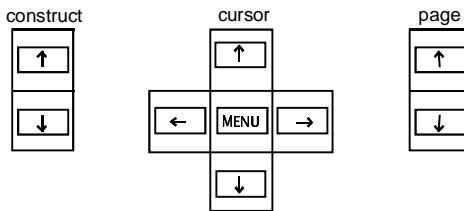


Press the <Menu> key to access the menu system. The LCD display then appears as shown below. This is referred to as

the *Main menu*.



You use the Construct, Cursor and Page arrow keys to navigate in the menu system. These keys are shown in Figure 5-2:

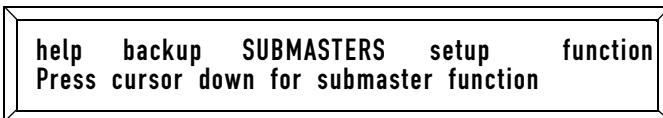


5

Figure 5-2. The menu navigational keys:  
Construct, Cursor and Page.

## **Menu Movement Keys**

The Cursor <Right> and <Left> arrow keys move side-to-side to select menu options. A selected menu option appears in ALL CAPS. For example, the figure below shows the **Submasters** option as being selected:

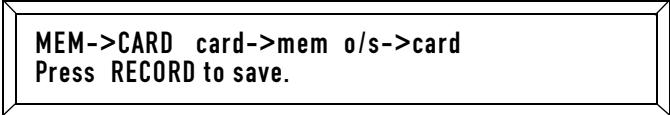


## **Moving Through Menu Levels**

The Cursor <Down> arrow key moves you *down* through the menu system one level at a time, while the Cursor <Up> arrow key moves you *up* through the menus one level at a time.

For example, use the Cursor <Right> and <Left> arrow keys to select **Backup** from the Main menu, then press the Cursor <Down> arrow key once. The LCD display appears as shown

below:



```
MEM->CARD card->mem o/s->card
Press RECORD to save.
```

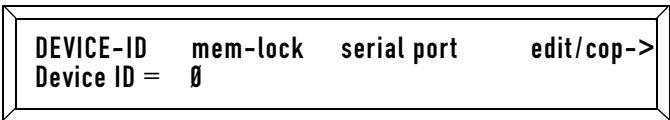
Pressing the Cursor <Down> arrow key again has no effect, since there are no menu items below **MEM->CARD**.

Pressing the Cursor <Right> and <Left> arrow keys select different menu options on the same level, and pressing the Cursor <Up> arrow key returns you to the Main menu.

## **Selecting Options**

Usually the Construct <Up> and <Down> arrow keys are used to select options for the lowest-level menu items. If another key is required (for example, the <Address>/<Preset> key), a message on the LCD display appears.

For example, select **Setup** from the Main menu and press the Cursor <Down> arrow key. The LCD display appears as shown below:



```
DEVICE-ID mem-lock serial port edit/cop->
Device ID = <empty>
```

Change the value for Device ID using the Construct <Up> and <Down> arrow keys. When you are done, press the Cursor <Up> arrow key or the <Menu> key.

**Note** The right-pointing arrow on the **Edit/Copy** menu option indicates there are more menu options than will fit on one screen. Keep pressing the Cursor <Right> arrow key to display more options.

## **Multi-Page Menus**

Some of the Help menus are more than one page long. You use the Construct <Up> and <Down> arrow keys to scroll through those multi-page menus.

Select **Help** from the main menu, then press the Cursor <Down> arrow key to select the first option, **Help**. The LCD display appears as shown below:

Use construct arrow keys to move through the help text. Try this now (arrow down).>

Press the Construct <Down> arrow key to display the next page of the help screen, which is shown below:

<Correct! You can exit help at any time  
by pressing the menu button. >

You now have the following options:

- Press the Cursor <Up> arrow key to return to the Help menu.
- Press the Construct <Down> arrow key to view additional help pages.
- Press the <Menu> key to exit the menu system.

# **Selecting MSC or LSC**

---

MIDI Show Control (MSC) and Lightwave Show Control (LSC) are two different protocols (languages) that achieve the same effect: coordinating and controlling playback of master controllers. (MSC and LSC have no effect on slaved controllers, since playback of slaved controllers is determined by masters.)

These protocols allow you to set up cue lists to determine the order in which your programmed presets or pages are played back. Both show control protocols are supported by the full line of Lightwave Research LCD controllers, including this one. The difference between them is what “show control” program you must use, as explained below:

- MSC is an industry-standard show control protocol that is supported by a wide variety of controllers, including the Lightwave Research series of LCD controllers and the Status Cue® system.
- LSC is supported by Lightwave Control Center (LCC) software only and works with Lightwave Research LCD controllers. You can order LCC free of charge from your High End Systems dealer/distributor (part number 80440004 for the PC version or 80440003 for the Macintosh® version).

## **Selecting the Protocol**

1. Press the <Menu> key to enter the menu system.
2. Select **Setup** from the Main menu, as shown below:

help backup submasters SETUP function  
Press cursor down for setup functions.

3. Press the Cursor <Down> arrow key to display the menu options shown below:

```
DEVICE-ID mem-lock serial port edit/cop->
Device ID =   Ø
```

4. Use the Cursor <Right> and <Left> arrow keys to select **Serial port**, as shown below:

```
device-id mem-lock SERIAL PORT edit/cop->
Use RS-232 port for Lightwave Control.
```

5. Press the Construct <Up> and <Down> arrow keys to change the selection between **MIDI Show Control GO commands** or **RS-232 port for Lightwave Control**.
6. Use the Cursor <Left> arrow key to select **Device-ID** and continue with the next section.

## ***Setting the Device ID***

The device ID is used by MSC and LSC to identify master controllers.

- In LSC, ID 0 (zero) means that the device responds to any ID. For example, if you were to send out commands to device ID 7 or ID 14 or ID 112, the controller with device ID 0 would respond. Device ID 0 is the default setting.
- MSC uses device ID 127 instead of ID 0 to tell a device to respond to any ID.

If you are continuing from the previous section, begin with Step 3.

1. Enter the menu system by pressing the <Menu> key.
2. Select **Setup** from the Main menu, as shown below:

help backup submasters SETUP function  
Press cursor down for setup functions.

3. Press the Cursor <Down> arrow key. The LCD display appears as shown below:

DEVICE-ID mem-lock serial port edit/cop->  
Device ID = 0

4. The LCD display above indicates the controller is currently set for the default ID of 0.
5. Use the Construct <Up> and <Down> arrow keys to change the value of the **Device-ID**. Values range from 1 to 223 for LSC and 0 to 126 for MSC.
  - In LSC, ID 0 (zero) means that the device responds to any ID.
  - MSC uses device ID 127 to tell a device to respond to any signal.
6. Press the Cursor <Right> and <Left> arrow keys to select another menu item, or press the Cursor <Up> arrow key to return to the Main menu.
7. *If you selected MIDI Show Control, you must power cycle the controller. Turn the power OFF then back ON.*

# All-Memory Playback

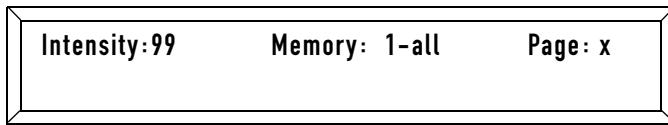
---

This section describes how to auto advance or random advance through all 99 pages in all nine memories. (Only initialized, or programmed, pages will play back.)

## Enabling All-Memory Playback

Make sure the controller is ready for programming as shown in Figure 4-1 on page 4-3.

Press the Cursor <Up> and <Down> arrow keys until the LCD display shows either: **1-all** or **9-all**, as shown below:



5

To access **1-all** or **9-all**, do the following:

- **1-all:** Press Cursor <Down> on memory 1.
- **9-all:** Press Cursor <Up> on memory 9.

If you select **1-all** and also press the <Auto> key, the initialized (programmed) pages in memory 1 begin playing back starting with page 1. When the controller completes playing back memory 1's initialized pages, it advances to memory 2, and plays back all of its initialized pages. This playback process continues through memory 9, page 99 then repeats until you disable all-memory playback.

Pressing the User <1> key randomizes the order of the pages being played back. For more information about the User keys, see the section titled “User Key Macros” on page 6-9.

## Disabling All-Memory Playback

Press the Cursor <Up> and <Down> arrow keys until “-all” no longer appears as part of the Memory value in the LCD display.

# ***Locking/Unlocking Memory***

---

Use the memory lock function to lock out all pages in a memory so they cannot be edited or erased without the memory first being unlocked. Locking a memory also prevents editing of any preset referring to any page in that memory.

1. Enter the menu system by pressing the <Menu> key.
2. Use the <Right> and <Left> arrow keys to select **Setup** from the Main menu, as shown below:

help backup submasters SETUP function  
Press cursor down for setup functions.

3. Press the Cursor <Down> arrow key to view setup options. Then use the <Right> and <Left> arrow keys to select **Mem-lock** from the Setup menu, as shown below:

device-id MEM-LOCK serial port edit/cop->  
Use A/P keys 1-9, Off = locked

4. Press the <Address>/<Preset> keys of the memories that you want to lock out to prevent unwanted editing. Locking a memory causes the numbered LED to turn OFF (for example, locking memory 2 causes the <2> LED to turn OFF).
5. Press the <Menu> key to lock the selected memories.

**Note** Memories 8 and 9 lock and unlock together. For example, locking memory 8 also locks memory 9.

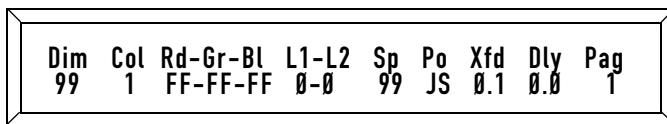
# ***Locking/Unlocking a Fixture***

---

This feature temporarily removes a fixture from all pages. This might be necessary in the event of a fixture malfunction or if you want to remove a fixture for a special event or effect. Removing a fixture in this manner requires no reprogramming because no memory is actually changed.

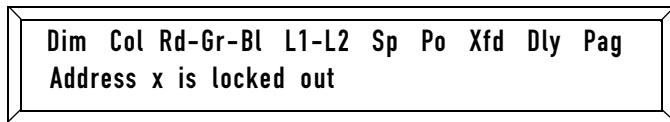
Use the same procedure to return the fixture to normal operation. Locked fixtures are unlocked at controller power-up as well.

1. Press and hold for 15 seconds the Address key of the fixture that you want to lock out. The LCD display shows the current parameter settings for that fixture, similar to the one shown below:



**5**

2. After 15 seconds the bottom line in the LCD display appears as shown below:



# **Erasing All Memory**

---

The Erase All function provides a quick way to clear all programming (all unlocked memories, all pages, all presets). This operation does *not* affect any locked memories, the controller's operating system, User key macros, menu choices (for example, device ID) or submasters.

**Note** You may want to temporarily back up the controller before you perform this operation. For more information, see Chapter 7.

1. Enter the menu system by pressing the <Menu> key.
2. Use the Cursor <Right> and <Left> arrow keys to select **Setup** from the Main menu, as shown below:

help backup submasters SETUP function  
Press cursor down for setup functions.

3. Press the Cursor <Down> arrow key to view Setup options, then use the Cursor <Right> and <Left> arrow keys to select **Erase All** from the Setup menu, as shown below:

<-port edit/copy ERASE ALL erase user ba->  
Hold SELECT, press ERASE to clear memory

4. Press and hold the <Select> key, then press the <Erase> key. ***Do not release the <Select> key.*** The LCD display then appears as shown below:

<-port edit/copy ERASE ALL erase user ba->  
SELECT & ERASE confirms, SELECT cancels.

5. While still holding the <Select> key, press the <Erase> key again. The system performs a power-on restart to complete the operation.

# ***Setting the Backlight Intensity***

---

You can set the intensity (brightness) of the LCD display backlight to high (the default), low, or off.

1. Enter the menu system by pressing the <Menu> key.
2. Select **Setup** from the Main menu, as shown below:

help backup submasters SETUP function  
Press cursor down for setup functions.

3. Press the Cursor <Down> arrow key, then press the Cursor <Right> arrow key until **Backlight** is selected, as shown below:

<-dit/copy erase all erase user BACKLIGHT  
LCD backlight is set to high.

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4. Use the Construct <Up> and <Down> arrow keys to set the intensity.



# ***Chapter 6***

# ***Advanced Programming***

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# ***Who Should Use this Chapter***

---

This chapter is intended for users already familiar with controller operation and with the basics of programming. In many cases, details such as how to enter or exit the controller's menu system have been omitted.

Consult the sections shown below for details of controller operation not covered in this chapter:

- “Rear Panel Descriptions” on page 2-2
- “MIDI In and Out Ports” on page 2-22
- “Other Connectors” on page 2-23
- “Front Panel Descriptions” on page 3-4
- “Using the Construct Keys” on page 3-8
- “Using the Construct Keys” on page 3-8
- “Creating a Program” on page 4-10
- “Preset Programming” on page 4-19
- “Viewing and Editing Programs” on page 4-25
- “Navigating the Menus” on page 5-4
- “Selecting MSC or LSC” on page 5-8
- “All-Memory Playback” on page 5-11

# **Using Position Presets**

---

The controller has a time-saving feature called position preset (also called *position memory* or *preset positioning*). Position presets allow one page to refer to another page for pan and tilt (position) information.

You first move the beam to the desired location using the joystick, then assign that position to a preset number (from 1 to 99). You can recall the same position preset in other pages. If you later change the position preset, all other pages referencing that preset are automatically changed, eliminating the need to reprogram the pages individually.

*Memory 9 is designated as “position memory.”* You can program all 99 pages as position presets, and you can still use all pages in memory 9 not reserved for position presets for page programming.

6

The following is a typical example of position presets: your show is programmed for a specific focus—the lead singer is downstage center, the drummer is upstage center, and the keyboard player is stage left. Memory 9, page 1 is programmed with all fixtures directed at the lead singer (downstage center). This is position preset 1. You use position preset 2 (memory 9, page 2) with all fixtures directed at the drummer and position preset 3 for the keyboard player.

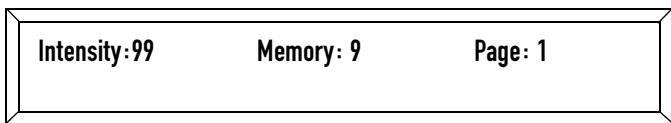
If you want to use position preset 1 (lead singer, downstage center) on memory 1, page 1, press the <POS> construct key and then use the Cursor <Up> and <Down> arrow keys to select **PRESET 1**.

As you move from venue to venue, your stage layout changes slightly. So for example if the singer’s focus at upstage center is 6 feet to the right of the last venue, you would change position preset 1 (memory 9, page 1). Do the same for the other band members, if necessary. No other programming is necessary.

The full set of 99 position presets is available for all fixtures connected to the controller. For example, suppose you have programmed all 99 pages of memory 9 as position presets. All 99 position presets are available for fixture number 1, all 99 position presets are available for fixture number 2, etc.

## ***Recording Position Presets***

1. Use the Cursor <Up> and <Down> arrow keys to select memory 9, then use the Page <Up> and <Down> arrow keys to select a page. This page becomes the position preset number (from 1-99). For example, the LCD display below shows memory 9, page 1 (preset 1) being selected:

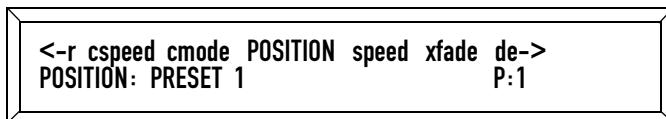


2. Press the <Select> key. The Select LED flashes.
3. Press the Address keys of all fixtures you want to include in this position preset. To open the gate (shutter) if it isn't open already, press the <Gate> key and select **Open**.
4. Use the joystick to position the beam.
5. Press the <Record> key. The pan and tilt (position) information for this position preset is now recorded, and you can reference this position in other pages as shown in the next section.

## ***Recalling Position Presets***

1. Select the memory (from 1—8) and page you want to program.
2. Press the <Select> key. The Select LED flashes.
3. Press the Address keys of all fixtures you wish to use a position preset for.

4. Press the <POS> (Position) construct key and use the Construct <Up> and <Down> arrow keys to select a position preset. (A value of JOYSTICK indicates you are using manual positioning, not preset positioning.) For example, the LCD display below selects position preset 1 (memory 9, page 1):



5. Edit any other constructs you wish, then press the <Record> key to save your selections and continue.

Use the same procedure to change your position presets as needed. Once you have changed a preset position, all pages that refer to the preset position will also change automatically.

## ***Address Parameter Copy***

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You can copy some or all of the construct parameters from one fixture to other fixtures on the same page, or to another page. This saves time when you want many fixtures on a page or within a loop of pages to share the same or similar constructs.

First, you need to configure how address parameter copy works using the Edit/Copy menu option, as shown in the next section.

**Note** The two constructs that are not copied using the address parameter copy command are: Xfade (crossfade) and Delay. These constructs affect the entire page; you must set or edit their values on each page.

## **Edit/Copy**

The Edit/Copy feature has two options:

- **“Share all Constructs until selected” (the default):** Copies all of a fixture’s construct parameters to the fixture(s) you have selected to “copy to”. You can override this by pressing one or more Construct key(s) to copy *only* those constructs.
- **“Don’t share constructs until selected”:** You must select the particular construct(s) you *do* want to copy by pressing the appropriate Construct key(s) until the LED indicator above that key lights. Only the selected constructs are copied.

1. Select **Setup** from the Main menu, as shown below:

help backup submasters SETUP function  
Press cursor down for setup functions.

2. Select **Edit/Copy** from the Setup menu, as shown below:

<-ck serial port EDIT/COPY erase all era->  
Share all constructs until selected

3. Press the Construct <Up> and <Down> arrow keys to select an edit/copy function.
4. Press the <Menu> key to exit the menu system.
5. Now see one of the sections listed below:
  - “Copy Parameters to Another Fixture, Same Page” on page 6-7
  - “Copy Parameters From One Page to Another Page” on page 6-8

## ***Copy Parameters to Another Fixture, Same Page***

1. Select the memory and page containing the fixture with the parameters you wish to copy.
2. Press the <Select> key, then press the Address key with the construct parameters you want to copy.
3. Take one of the following actions:
  - If you selected “Share all constructs until selected”, do not press any construct Construct keys to copy *all* of the selected fixture’s constructs. Pressing one or more Construct keys means you will copy *only* the selected construct(s).
  - If you selected “Don’t share constructs until selected”, press the Construct keys of the constructs you *do* wish to copy.
4. Press one or more address keys to copy construct parameters to.
5. Press the <Record> key to save the changes or press the <Select> key to discard changes.

## **Copy Parameters From One Page to Another Page**

1. Select the memory and page containing the fixture with the parameters you wish to copy.
2. Press the <Select> key. The LCD display appears as shown below:

Select fixtures to edit using A/P keys,  
or press SELECT to exit.

3. Press the Address key(s) corresponding to the fixture(s) you wish to copy. Remember the page number containing these fixtures.
4. Press the Page <Up> and <Down> arrow keys to select the destination page. The destination page value is displayed in the lower right corner of the LCD display.

GATE dim color cspeed cmode position sp->  
GATE: OPEN P: x

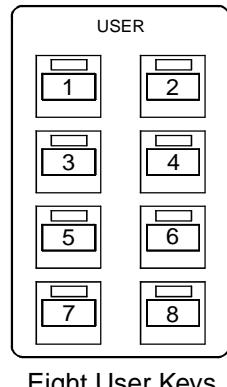
5. Take one of the following actions:
  - If you selected “Share all constructs until selected”, do not press any construct Construct keys to copy *all* of the selected fixture’s constructs. Pressing one or more Construct keys means you will copy *only* the selected construct(s).
  - If you selected “Don’t share constructs until selected”, press the Construct keys of the constructs you *do* wish to copy.
6. Press the <Record> key to perform the copy or press the <Select> key to cancel without copying.

# User Key Macros

The controller has eight front panel User keys that can be used to store custom *macros* (a recorded series of up to 256 keystrokes); five of the first six keys have pre-programmed definitions that you can use or record over. (You can access the default definitions even after you record over the keys.)

User keys 1 through 8 are factory programmed as follows:

- User 1 – Random (time) advance
- User 2 – Color modulate
- User 3 – Audio advance 1
- User 4 – Undefined (not programmed)
- User 5 – Audio advance 2
- User 6 – Dim modulate
- User 7 – Undefined (not programmed)
- User 8 – Undefined (not programmed)



6

## Recording or Editing User Key Macros

A *macro* is a recording of up to 256 keystrokes that you can assign to any of the eight User keys. Simply pressing the assigned User key immediately plays back the macro.

**Note** Press the same User key again to toggle off and on the key function.

1. Press and hold the User key you wish to record until **Edit user key** appears on the LCD display, then release the key. The LCD display then appears as shown below:

**CANCEL playback record function**  
**Press cursor down to cancel macro recall**

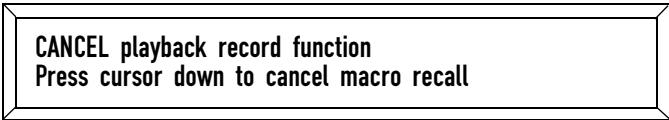
2. Select **Record** from the menu.

3. The selected User key's LED flashes, indicating you are recording. Every keystroke you make from now on is recorded in this macro. The macro accepts up to 256 keystrokes. See the example below.
4. When you have completed your macro, repeat Step 1 then select **Stop Record** from the menu.

### Example Macro: Page Copy

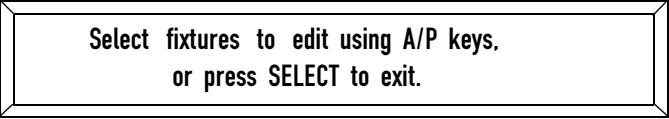
This macro copies the entire contents of the page the controller is currently set on to another page.

1. Select a memory and page to copy from using the Cursor and Page <Up> and <Down> arrow keys.
2. Press the User key <7> until **Edit user key** appears on the LCD display, then release the key. The LCD display then appears as shown below:



CANCEL playback record function  
Press cursor down to cancel macro recall

3. Select **Record** from the menu.
4. The User key <7> LED flashes, indicating you are recording.
5. Press the <Select> key. The LCD display then appears as shown below:

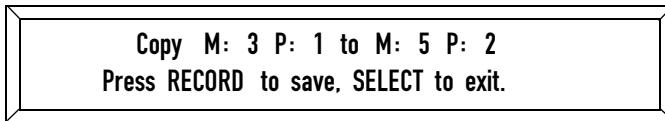


Select fixtures to edit using A/P keys,  
or press SELECT to exit.

6. Select the memory and page (destination) you want to copy the contents of the current page to:
  - Press the Cursor <Up> and <Down> arrow keys to change the memory number.
  - Press the Page <Up> and <Down> arrow keys to change the page number.

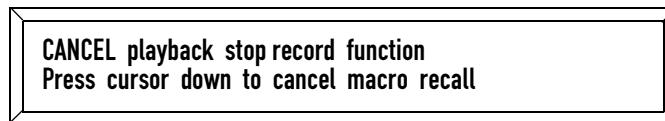
**Note** Make sure the page you select does not already contain a program, because the page would be erased.

7. When you press the Cursor or Page key for the first time, the LCD display shows the source memory and page fields. The destination memory and page fields follow your key presses.



The sample LCD display above will copy the contents of memory 3, page 1 to memory 5, page 2.

8. Press the <Record> key to complete the page copy.
9. Press the User key <7> until **Edit user key** appears on the LCD display, then release the key. The LCD display then appears as shown below:



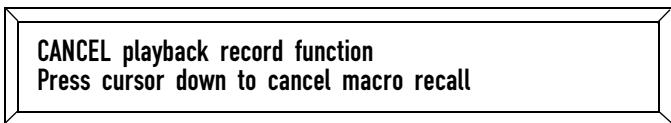
10. Use the Cursor <Right> and <Left> arrow keys to select **Stop Record** from the menu, then press the Cursor <Down> arrow key.
11. The User <7> LED goes off, indicating the macro has been recorded. Now when you press the User <7> key, the page copy is automatically performed.

## ***Erasing a Single User Key***

To erase one of the User keys, record a zero-keystroke macro over the old macro using the instructions in this section.

**Note** Erasing an individual User key does not return it to its default definition. However, you can restore all six User keys to their default definitions as shown in the section titled “Erasing All User Keys” on page 6-14.

1. Press and hold the User key you wish to erase until **Edit user key** appears on the LCD display, then release the key. The LCD display then appears as shown below:



CANCEL playback record function  
Press cursor down to cancel macro recall

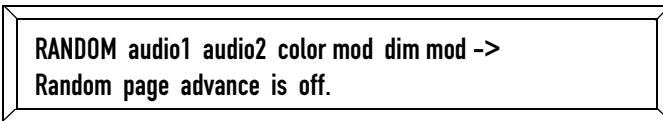
2. Select **Record** from the menu.
3. The selected User key’s LED flashes, indicating you are recording.
4. Press and hold the same User key until **Edit user key** appears on the LCD display, then release the key.
5. Select **Stop Record** from the menu.
6. The key stops flashing to indicate you are through recording. Pressing the User key again displays the following message:  
**This userkey is empty. Playback stopped.**

## **Accessing Default Definitions**

This section describes how to access the six default User key definitions after any or all of these keys have been redefined as macros.

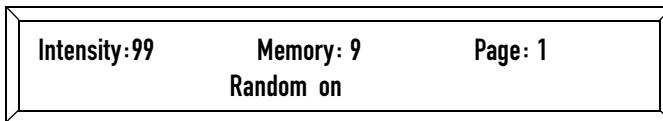
**Note** You can restore all six User keys to their original pre-programmed state by erasing all User keys. See the section titled “Erasing All User Keys” on page 6-14.

1. Select **Function** from the Main menu, then press the Cursor <Down> arrow key.
2. The LCD display appears as shown below:



RANDOM audio1 audio2 color mod dim mod ->  
Random page advance is off.

3. Select the desired option with the Cursor <Right> and <Left> arrow keys, then use the Construct <Up> and <Down> arrow keys to enable or disable the option.
4. To complete the operation, press the <Menu> key. A slowly-blinking message on the LCD display reminds you this function is enabled.



Intensity:99      Memory: 9      Page: 1  
Random on

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The sample LCD display above appears when you enable random advance. The words **Random on** blink slowly to remind you the feature has been enabled.

5. Use the same procedure to disable the function.

## **Erasing All User Keys**

Erasing all User keys deletes any custom macros you have programmed and returns the eight User keys to their default definitions. (Memories, pages, presets, submasters, menu choices and the controller's operating system are not affected.) For more information about User keys, see the section titled "User Key Macros" on page 6-9.

1. Select **Setup** from the Main menu, as shown below:

help backup submasters SETUP function  
Press cursor down for setup functions.

2. Select **Erase User** from the Setup menu, as shown below:

<-dit/copy erase all ERASE USER backlight  
Hold SELECT & ERASE to clear userkeys.

3. Press and hold the <Select> key, then press the <Erase> key. ***Do not release the <Select> key.*** The LCD display then appears as shown below:

←serial port edit/copy erase all ERASE USER  
SELECT & ERASE confirms, SELECT cancels.

4. While still holding the <Select> key, press the <Erase> key again. (Press either <Select> or <Menu> to exit without erasing the User keys.)

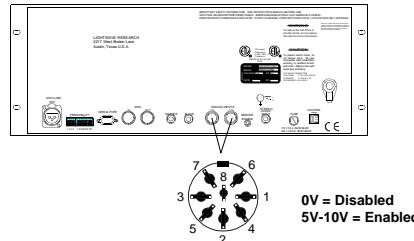
# Analog Inputs Ports

You can attach an analog controller to the two Analog Inputs ports located on the Studio Color LCD controller's rear panel to perform any of the following functions:

- **Remote page access:** Remotely play back pages from the memory. For more information, see “Remote Page Access” on page 6-16. Set switch B-3 on the Studio Color LCD controller’s rear panel to OFF.
- **Remote preset access:** Remotely record and play back presets using either twelve-level preset access or binary preset access. For more information, see “Remote Preset Access” on page 6-18. Set switch B-3 on the Studio Color LCD controller’s rear panel to ON.
- **Submasters:** Use an analog controller(s) to adjust in real-time the Dim and Color construct parameters. For more information, see “Submasters” on page 6-23.

Figure 6-1 shows pinouts for the ports.

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Port	Connector Pin Number	Channel	Port	Connector Pin Number	Channel
1-6 (left)	1	Not used	7-12 (right)	1	Not used
	2	DC Negative		2	DC Negative
	3	1		3	7
	4	2		4	8
	5	3		5	9
	6	4		6	10
	7	5		7	11
	8	6		8	12

Figure 6-1. Pinouts of the two Analog Inputs ports.

# **Remote Page Access**

---

The remote page access feature allows you to remotely play back pages from the memory that you first select on the controller's front panel. (You cannot remotely select or change memories.)

1. Connect the analog controller as described in the section titled “Analog Inputs Ports” on page 6-15. Set switch B-3 on the Studio Color LCD controller’s rear panel to OFF.
2. Select the memory containing the pages you want to remotely access using the Cursor <Up> and <Down> arrow keys.
3. From the analog controller perform the applicable procedure, a through c, to select the desired page. Table 6-1 summarizes the channel functions.

**0V = Disabled**

**5V-10V = Enabled**

- a. Channels 1 through 12 on the analog controller correspond directly to pages 1 through 12 on the Studio Color LCD controller.

Thus, if you enable channel 1 on the analog controller, you call up page 1 on the Studio Color LCD controller, channel 2 calls up page 2, and so on.

- b. Simultaneously enabling any combination of two channels on the analog controller calls up the page number corresponding to the combination of the two channel numbers (lowest number first). For example, if you simultaneously enable channels 1 and 2, you call up page 12. Enabling channels 7 and 3 calls up page 37.

- c. Channels 10, 11, and 12 when used in combination with other channels become function keys as explained below:
- Channel 10 is a ten-times multiplier. For example, if you simultaneously enable channels 5 and 10, you call up page 50.
  - Channel 11 is an eleven-times multiplier. For example, if you simultaneously enable channels 2 and 11, you call up page 22.
  - Channel 12 is a number inverter. For example, if you simultaneously enable channels 2, 4, and 12, you call up page 42 rather than page 24.

*Table 6-1. Remote Page Access Channel Functions*

Channels 1-12	Directly access pages 1-12.
Channel 10 + one other channel	Ten-times multiplier for channels 2-9 to allow access to pages 20, 30, 40, 50, 60, 70, 80, and 90.
Channel 11 + one other channel	Eleven-times multiplier for channels 2-9 to allow access to channels 22, 33, 44, 55, 66, 77, 88, and 99.
Channel 12 + two other channels	Inverts the order of the two lowest channels enabled simultaneously. For example 23 becomes 32.
<b>0V = Disabled</b> <b>5V-10V = Enabled</b>	

**Note** If enabling analog controller channels does not call up pages in memory, make sure there are no submasters assigned. See the section titled “Submasters” on page 6-23.

# **Remote Preset Access**

---

Twelve-level preset access and binary preset access allow you to do one or both of the following:

- Play back individual pages or loops (even individual pages within loops).
- Play back the same loop with different settings for: auto advance, audio 1 and 2 advance, random advance, color modulate or dim modulate.

More detail about each kind of preset access is shown below:

- **Twelve-level preset access:** Record and play back up to 96 presets (eight presets for each of 12 channels). This is a “hands-on” method, since you need to first enable an analog controller channel then press a Preset key on the Studio Color LCD controller’s front panel.
- **Binary preset access:** Record and play back up to 1023 presets (each of 10 analog channels is a binary digit). This mode offers the greatest flexibility for total remote, “hands-off” control since all input is done on the analog controller.

## **Setting Up the Controller**

Connect the analog controller as described in the section titled “Analog Inputs Ports” on page 6-15. Set switch B-3 on the Studio Color LCD controller’s rear panel to ON. Then do one of the following:

- 12-level preset access: Set switch B-5 to OFF.
- Binary preset access: Set switch B-5 to ON.

## **Using Twelve-Level Preset Access**

Twelve-level preset access allows you to record and play back up to 96 presets (12 sets or levels of eight presets each).

### **Recording in Twelve-Level Preset Access**

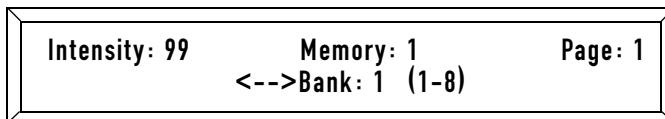
1. Toggle the <Address>/<Preset> key on the Studio Color LCD controller until the Preset LED comes ON.
2. Press the Page <Up> and <Down> arrow keys on the Studio Color LCD controller to select the page that you want to record as a preset. If you want to record a loop as a preset, select any page within the loop.
3. *This step applies to loops only.* Press the <Auto> key. The pages start advancing, playing back the loop.
4. Press the <Select> key. The Select LED flashes.
5. Enable the analog controller channel corresponding to the level you wish to use. (The signal that you use can be momentary or latching.)
6. For example, for level 1 (the first 8 presets), enable channel 1 on the analog controller. For level 2 (the second set of 8 presets, 9 to 16), enable channel 2 on the analog controller, etc.

**6**

**0V = Disabled**

**5V-10V = Enabled**

7. Use the Cursor <Right> and <Left> arrow keys to set the controller for preset bank 1 as shown below:



8. Press the Preset key (1 through 8) on the front panel on the Studio Color LCD controller where you want to store the preset. Adjust the settings for auto advance (page 4-18),

audio 1 and 2 advance (page 6-27), color modulate (page 6-27) and dim modulate (page 6-27) as needed. These settings are stored with the preset.

9. Press the <Record> key. The Select LED stops flashing, indicating the preset is now recorded.

**Note** If enabling analog controller channels does not call up presets in memory, make sure there are no submasters assigned. See the section titled “Submasters” on page 6-23.

## Playing Back in Twelve-Level Preset Access

1. Enable the analog controller channel corresponding to the preset level you wish to access. For example, to access one of the first level of eight presets, enable analog controller channel 1. To access one of the second level of eight presets (9 through 16), enable controller channel 2.

**Note** The highest-numbered channel takes precedence if you simultaneously enable two channels.

**0V = Disabled**

**5V-10V = Enabled**

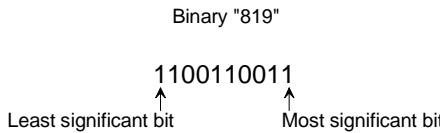
2. Toggle the <Address>/<Preset> key on the Studio Color LCD controller until the Preset LED is ON.
3. Press one of the eight Preset keys on the Studio Color LCD controller’s front panel to play back that preset.
4. The preset continues to play back until you:
  - press another Preset key
  - change to another preset level by activating another channel on the controller
  - press the <Standby> key until the Standby LED comes ON
  - manually change the memory or page

## **Using Binary Preset Access**

Binary preset access allows you to record and play back up to 1023 presets (the first 10 analog controller channels act as binary digits).

The controller supports mixing binary presets with submasters; however, the same channel cannot serve as both a submaster and a preset at the same time. The submaster takes precedence over the preset.

If want to mix submasters and binary presets, you should assign submasters from the top down in order (for example, channel 12 first, then 11, then 10, and so on) to simplify the binary preset addressing scheme because binary preset access begins with the least significant bit (left to right in binary). Also see “Submasters” on page 6-23.



**6**

*Figure 6-2. The least significant bit in binary is the leftmost digit.*

## **Recording in Binary Preset Access**

1. Press the <Address>/<Preset> key until the Preset LED comes ON.
2. Use the Page <Up> and <Down> arrow key to select the page that you want to record as a preset. If you want to assign a loop to a preset, select any page within the loop.
3. *This step applies to loops only.* Press the <Auto> key. The pages start advancing, playing back the loop.
4. Press the <Select> key. The Select LED flashes.
5. Press any of the numbered Preset keys—the key that you press is not important; this action only alerts the controller that you are about to record presets. Adjust the settings for

auto advance (page 4-18), audio 1 and 2 advance (page 6-27), color modulate (page 6-27), and dim modulate (page 6-27) as needed. These settings are stored with the preset.

6. Convert the preset number you wish to use to a binary number using Appendix A. Then enable all analog controller channels corresponding to binary 1s and disable controller channels corresponding to binary 0s.

**0V = Disabled**

**5V-10V = Enabled**

Examples:

- Preset 1: preset 1 in binary is 1000000000. Enable controller channel 1 but do not enable channels 2 through 10.
- Preset 948: preset 948 in binary is 0010110111. Enable channels 3, 5, 6, 8, 9 and 10 but do not enable channels 1, 2, 4 or 7.

Analog controller channels 11 and 12 control blackout and standby, as shown below:

- Channel 11 (blackout): closes all fixtures' shutters but wheels and effects continue to run.
- Channel 12 (standby): activating channel 12 when the controller is in standby (Standby LED is ON) takes the controller out of standby. Activating channel 12 when the controller is *not* in standby (Standby LED is OFF) has no effect. When the controller is in standby, all fixtures' shutters close and any in-progress wheel changes stop immediately. Controller pages continue to advance.

7. Press the <Record> key. The Select LED stops flashing and one of the Preset LEDs on the front panel comes ON, indicating that you recorded a preset. The “Preset Key” column in Table A-1 shows which LED will be ON.

**Note** If enabling analog controller channels does not call up presets in memory, make sure there are no submasters assigned. See the section titled “Submasters” on page 6-23.

## Playing Back in Binary Preset Access

Appendix A lists all of the binary preset access combinations.

The selected preset continues to play back until you:

- press another Preset key
  - change to another preset level by activating another channel on the controller
  - toggle the <Standby> key until the Standby LED comes ON
  - manually change the memory or page

## ***Submasters***

A *submaster* is an analog 0-10 V controller you can use to remotely adjust (override), in real time, the dim and color construct parameters for selected fixtures. You can define up to 12 submasters and control them using one or more analog controllers.

The Studio Color LCD controller supports mixing binary presets with submasters; however, the same channel cannot serve as both a submaster and a binary preset at the same time. The submaster takes precedence over the preset.

If want to mix submasters and binary presets, you should assign submasters from the top down in order (for example, channel 12 first, then 11, then 10, and so on) to simplify the binary preset addressing scheme because binary preset access begins with the least significant bit (left to right in binary).

## Binary "819"

1100110011

↑  
Least significant bit      ↑  
Most significant bit

*Figure 6-3. The least significant bit in binary is the leftmost digit.*

## Selecting a Submaster Mode

There are two submaster modes: Proportional level or Remote level.

- **Proportional Level submasters (typical setting):** Traditional submaster control. The submaster value is multiplied by the programmed fixture value. For example, if the recorded dim value for the selected fixture is at 50 percent and a submaster is at 50 percent, the fixture will be dimmed at 25 percent.  
If there are two or more submasters, the submaster with the higher setting has control. For example, suppose you assigned 2 submasters to one fixture. You set submaster 1 at 20 percent dim and submaster 2 at 50 percent dim. The 50 percent submaster has control because it is the larger value.
- **Remote Level submasters:** The device with the higher level has control. For example, if you program the fixture for 50 percent dim and the submaster for 60 percent dim, the submaster has control.

1. Select **Submasters** from the Main menu, as shown below:

```
help backup SUBMASTERS setup function  
Press cursor down for submaster function
```

2. Select **Mode** from the Submasters menu, as shown below:

```
MASTER 1 2 3 4 5 6 7 8 9 10 11 12 [MODE]  
Proportional level submasters selected.
```

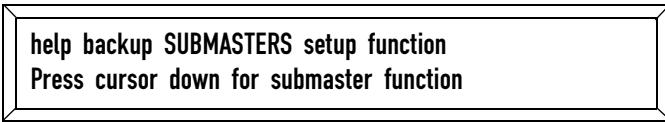
3. Use the Construct <Up> and <Down> arrow keys to make a selection.
4. Press the <Menu> key to save your selection and exit the menu system.

## **Assigning a Channel for Master Dim**

This section explains how to use a submaster as the “master dim controller”. Once you assign a channel for master dim, the same channel cannot be used to control fixtures. For example, if you select channel 1 for master dim, you cannot use channel 1 to control fixtures.

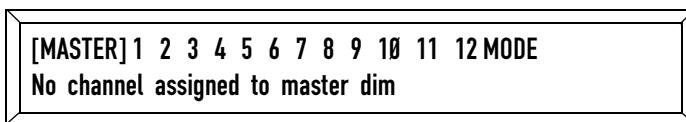
**Note** When the master dim is assigned to a channel, you should *not* use the Studio Color LCD controller for master dim control; master dim should be controlled by the submaster “master dim controller”.

1. Select **Submasters** from the Main menu, as shown below:



help backup SUBMASTERS setup function  
Press cursor down for submaster function

2. Press the Cursor <Down> arrow key. The LCD display then appears similar to the one shown below:



[MASTER] 1 2 3 4 5 6 7 8 9 10 11 12 MODE  
No channel assigned to master dim

3. Use the Construct <Up> and <Down> arrow keys to select a channel for master dim. Remember that the channel you assign to master dim cannot also be assigned as a submaster.
4. After you set the channel for master dim, you can assign submaster channels as shown in the next section.

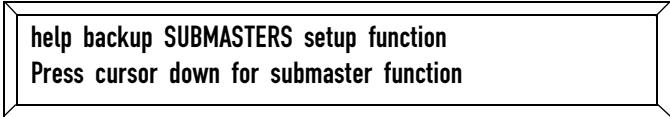
6

## **Assigning Fixtures to a Submaster**

To have a particular submaster control the dimming or color of a particular fixture(s), you have to assign that fixture(s) to that submaster. There are 12 submasters available (or eleven if you assigned one channel to master dim).

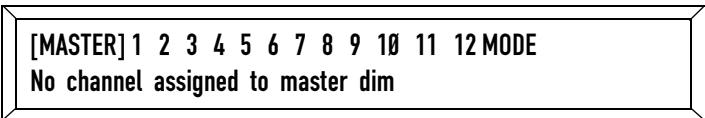
You can skip the first two steps below if you are continuing from the previous section.

1. Select **Submasters** from the Main menu, as shown below:



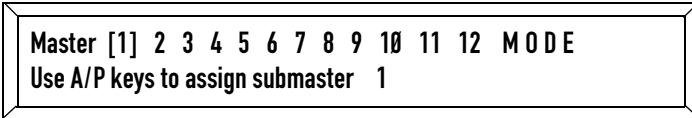
```
help backup SUBMASTERS setup function  
Press cursor down for submaster function
```

2. The LCD display then appears similar to the one shown below:



```
[MASTER] 1 2 3 4 5 6 7 8 9 10 11 12 MODE  
No channel assigned to master dim
```

3. Use the Cursor <Right> and <Left> arrow keys to select the submaster number as shown below (submaster 1):



```
Master [1] 2 3 4 5 6 7 8 9 10 11 12 MODE  
Use A/P keys to assign submaster 1
```

4. Press the <Address> keys of a fixture you want to assign to that submaster. (*You must select only one fixture at a time.*) The selected address LED comes ON to indicate that it is assigned to that submaster.
5. Press the <Color> key to have the submaster control color changes, or press the <Dim> key if you want the submaster to control dimming.

You can assign multiple fixtures to each submaster and you can also assign any particular fixture to multiple submasters.

6. Continue selecting one fixture at a time for submaster control. When you're done, press the <Menu> key to save your settings.

# **Audio Input Playback**

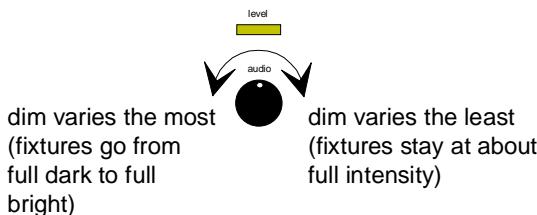
---

You can use an external stereo source to control playback through any or all four playback modes listed below. Audio input playback affects how initialized pages play back, regardless of whether those pages are part of a loop or not.

To enable audio input playback, plug your stereo source into the Stereo Audio Input connector on the controller's rear panel as shown in the section titled "Other Connectors" on page 2-23.

Also see the section titled "Random Advance" on page 6-29.

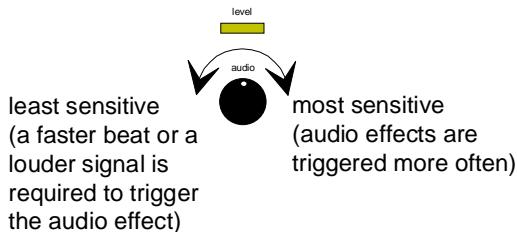
- **Audio 1 advance (User 3 key):** Pages advance with the amplitude of the audio signal.
- **Audio 2 advance (User 5 key):** Page advance pauses with the amplitude of the audio signal.
- **Color modulate (User 2 key):** Cycles through the six positions on the color wheels of all active fixtures with the beat of the audio signal, overriding the Color construct settings.
- **Dim modulate (User 6 key):** Light intensity of all active fixtures changes with the amplitude of the audio signal. You can adjust how much the dim varies (from full dim to full bright, or a small dim change resulting in a "flickering" effect) using the <Audio> knob, as shown in Figure 6-4:



*Figure 6-4. Adjusting the sensitivity of the dim modulate effect to the audio signal.*

## ***Varying the Audio Sensitivity***

Adjust the sensitivity of the audio advance modes to the audio signal using the <Audio> (level) knob located directly to the right of the <Rate> knob. See Figure 6-5.



*Figure 6-5. Adjusting the sensitivity of audio effects to the audio signal.*

**Note** If the Level LED does not come ON, or if you are having difficulty triggering audio effects, check the audio connections then increase the volume of your audio source. If the volume is already high, reduce the volume significantly then bring it back up again.

# **Random Advance**

---

Random advance when used with auto advance, manual advance or audio advance (and optionally all-memory playback) plays initialized pages in random order. (Random advance when enabled by itself does nothing.)

First press the <Auto> key, then enable random advance. By default, the User <1> key is defined as random advance. If you have already programmed a macro on the User <1> key, see the section titled “Accessing Default Definitions” on page 6-13.

**Note** Random Advance will sequence through initialized pages in different memories if you have selected all-memory playback as described in the section titled “All-Memory Playback” on page 5-11.

## **Live Control of Auto Playback**

---

This section explains how to have “live” control (override) over all of the constructs of one or more fixtures. For example, an activity occurs that you want to track with a “live spot”. You could quickly select a fixture to use as a spot and manually control its position with the joystick.

1. Press the <Select> key. The Select LED flashes.

**Note** You must press the <Select> key to stop the controller on a page that is *not* using a preset position or else you will not be able to change the beam position using the joystick.

2. Press the <Address> keys corresponding to the fixtures you wish to control. You can now change (override) any of the fixtures’ constructs; however, you cannot record the changes made during “live” control.

- To return from “live” control press the <Select> key. The Select LED stops flashing and the selected fixtures return to their original programmed settings.

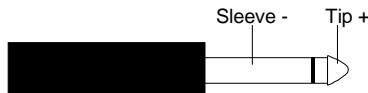
## ***Remote Enable***

---

Located on the rear panel of the controller is a Remote Enable connector that allows you to remotely enable and disable the controller as described below:

- Sending a voltage of 0 V DC disables the controller (all fixtures go dark, all wheels stop moving, and all in-progress moves finish immediately).
- Sending a voltage between +5 V to +16 V DC to returns the controller to its previous state. If the controller was previously in Standby (with the Standby LED ON), the controller returns to Standby; if the controller was *not* previously in Standby, the controller resumes operation.

The female 3.5 mm (1/8 in) mini-phone jack accepts a 3.5 mm mini-phone connector (male). (The controller functions normally with nothing attached to the Remote Enable connector.)



*Figure 6-6. Polarity of the remote enable connector.*

# ***Lightwave Control Center***

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Selecting Lightwave Show Control (LSC) as described in the section titled “Selecting MSC or LSC” on page 5-8 means you must use the Lightwave Control Center (LCC) software for playback control using binary preset access. (The eight preset keys on the controller’s front panel are not used with binary preset access.)

LCC allows you to set up cue lists so you can access your 1023 presets in any order.

**Note** LCC must be used in conjunction with binary preset access. For more information about binary preset access, see the section titled “Using Binary Preset Access” on page 6-21.

You can order LCC free of charge from your High End Systems dealer/distributor (part number 80440004 for the PC version or 80440003 for the Macintosh version).



# *Chapter 7*

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# **Overview**

---

This chapter describes options for backing up and restoring the controller's internal memory and operating system. You have different options depending on whether you use a RAM card or a personal computer.

You can also crossload memories, pages and presets directly from one controller to another controller. See the section titled "Crossloading" on page 7-30 for more information.

## ***RAM Card Options***

You can use a RAM card to back up and restore all of the controller's internal memory: memories and pages (programs), User keys, submasters, menu choices; or the operating system. You can back up internal memory or the operating system to have a spare copy or to transfer data from one controller to another.

Restoring internal memory from a RAM card overwrites *all existing data*, including pages in locked memories. If you want to preserve (*not* overwrite) locked memories, you should use the personal computer method described on the next page.

One RAM card holds either the contents of a controller's internal memory or a controller's operating system, but not both. If you want to back up both memory and the operating system, you will need two RAM cards.

The controller ships with one RAM card; you can order additional RAM cards from your High End Systems dealer/distributor (part number 80440017). The RAM card shipped with the controller is a Type 1 SRAM PC Card, 256KB. (You can use a larger-capacity PC Card, but the controller utilizes only 256KB.)

## ***Personal Computer Options***

In addition to backing up and restoring controller memory using a RAM card, you can also back up (download) and restore (upload) memories, pages and presets using a personal computer.

The differences between backing up and restoring memory via RAM card and personal computer are summarized below:

- You cannot back up or restore the controller's operating system using a personal computer.
- Backing up to a personal computer backs up pages, memories and presets only, while backing up to a RAM card backs up pages, memories, presets, submasters, menu choices, and User keys.
- Backing up to a personal computer backs up locked memories, but restoring memories from a personal computer to the controller does not overwrite locked memories.

## ***NiCad Battery Protection***

7

The controller's self-recharging Nickel Cadmium (NiCad) battery protects memory during power down or power failure. A fully-charged battery will preserve data for at least 6 weeks with the controller powered down the entire time.

Each NiCad battery is fully charged when your Studio Color LCD controller is shipped from the factory. Should a battery lose its charge, plug in your controller, power it ON and allow the battery at least 24 hours to fully recharge.

# ***RAM Card: Memory***

---

This section explains how to:

- Copy all of the controller’s internal memory to a RAM card
- Load or restore the controller’s memory from a RAM card

See also:

- “IBM-Compatible” on page 7-13
- “Macintosh” on page 7-24
- “Crossloading” on page 7-30

**Note** When you are not using a RAM card, you should write-protect it to avoid accidental data erasure. See the section titled “RAM Card: Write-Protection” on page 7-12.

## ***Backing Up to a RAM Card***

Use this procedure to save all of the controller’s internal memory to a RAM card (memories—including locked memories—, pages, user keys, menu choices and submasters). You can then use the RAM card to transfer this controller’s memory to another controller or you can put the RAM card away for safekeeping.

**Note** One RAM card can contain either a copy of the controller’s memory or operating system, but not both. To back up both the internal memory and operating system, you will need two RAM cards. See the section titled “Optional Accessories” on page 1-6 for ordering information.

1. Insert a RAM card into the RAM card slot on the controller’s front panel. The RAM card is designed to go in the slot only one way; ***do not force the card into the slot***. If you feel resistance, turn the card over and reinserit it.

2. Press the <Menu> key to enter the menu system.
3. Use the Cursor <Right> and <Left> arrow keys to select **Backup** from the Main menu, as shown below:

help BACKUP submasters setup  
Press cursor down for help.

4. Press the Cursor <Down> arrow key to view the possible selections, then use the Cursor <Right> and <Left> arrow keys to select **Mem->Card** as shown below:

MEM->CARD card->mem o/s->card  
Press RECORD to save.

If the message “**Press RECORD to save**” does not appear on the LCD display, see the explanation below:

- If there is no card in the RAM card slot, or if the RAM card is not fully inserted, the message appears: “**Card is not inserted.**” Fully insert a RAM card into the slot (but *do not force it* into the slot—turn it over if you feel resistance); the LCD display message changes to: “**Press RECORD to save.**”
  - If the RAM card’s write-protect switch is turned on, the message appears: “**Card is locked.**” Unlock the RAM card as shown in “RAM Card: Write-Protection” on page 7-12.
5. Press the <Record> key.

The LCD display then appears as shown below:

MEM->CARD card->mem o/s->card  
Are you sure? RECORD=save, SELECT=cancel

6. If you want to cancel the backup operation at this time press the <Select> key or the Cursor <Up> arrow key. Otherwise, press the <Record> key again if you are sure that you want to complete this backup operation.
7. After memory has been backed up, the controller is automatically placed in *mirror mode*, causing subsequent programming to be recorded to both the RAM card and to the controller's memory.
  - If you wish to use mirror mode, leave the RAM card in the slot.
  - If you do not wish to use mirror mode, write-protect the RAM card as shown in the section titled "RAM Card: Write-Protection" on page 7-12, then remove the RAM card and put it in a safe place.

## ***Restoring Memory from a RAM Card***

Use this procedure to load (or restore) all of the controller's memory from a RAM card to the controller.



**Caution** **This procedure completely replaces the current contents of the controller's memory (including locked memories) with the RAM card. You might want to back up the controller's memory first to another RAM card or to a personal computer as shown in the section titled "Backing Up to a RAM Card" on page 7-4, "IBM-Compatible" on page 7-13 or "Macintosh" on page 7-24.**

1. Insert a RAM card into the RAM card slot on the controller's front panel. The RAM card is designed to go in the slot only one way; ***do not force the card into the slot.*** If you feel resistance, turn the card over and reinsert it.
2. Enter the menu system by pressing the <Menu> key.

3. Use the Cursor <Right> and <Left> arrow keys to select **Backup** from the Main menu, as shown below:

```
help BACKUP submasters setup  
Press cursor down for help.
```

4. Press the Cursor <Down> arrow key to view the menu items, then use the Cursor <Right> and <Left> arrow keys to select **Card->Mem**, as shown below:

```
mem->card CARD->MEM o/s->card  
Press ERASE to load.
```

5. Press the <Erase> key to load the contents of the RAM card to the controller, or press the <Menu> key to exit without loading from the RAM card.
6. After pressing the <Erase> key, the LCD display appears as shown below:

```
mem->card CARD->MEM o/s->card  
Are you sure? ERASE=load, SELECT=cancel
```

7. Press the <Erase> key again to begin the load operation, or press the <Select> key to cancel the operation. The controller restarts after memory has been restored.
8. After memory has been restored, the controller is automatically placed in *mirror mode*, causing subsequent programming to be recorded to both the RAM card and to the controller's memory.
  - If you wish to use mirror mode, leave the RAM card in the slot.
  - If you do not wish to use mirror mode, write-protect the RAM card as shown in the section titled "RAM Card: Write-Protection" on page 7-12, then remove the RAM card and put it in a safe place.

# ***RAM Card: O/S***

---

This section explains how to back up, replace or update the controller's operating system from a RAM card.

**Note** When you are not using a RAM card, you should write-protect it to avoid accidental data erasure. See the section titled "RAM Card: Write-Protection" on page 7-12.

## ***Backing Up the Operating System to a RAM Card***

Use this procedure to back up the contents of the controller's operating system to a RAM card. You might want to do this before upgrading to a new operating system version, or to have a copy of the controller's operating system on a RAM card for safekeeping.

**Note** One RAM card can contain either a copy of the controller's memory or operating system, but not both. To back up both the internal memory and operating system, you will need two RAM cards. See the section titled "Optional Accessories" on page 1-6 for ordering information.

1. Insert a RAM card into the RAM card slot on the controller's front panel. The RAM card is designed to go in the slot only one way; ***do not force the card into the slot***. If you feel resistance, turn the card over and reinsert it.
2. Press the <Menu> key to enter the menu system.
3. Press the Cursor <Right> and <Left> arrow keys to select **Backup** from the Main menu, as shown below:

help BACKUP submasters setup  
Press cursor down for help.

4. Press the Cursor <Down> arrow key to view the menu options, then select **O/S->Card**, as shown below:

mem->card card->mem O/S->CARD  
Press RECORD to copy O/S.

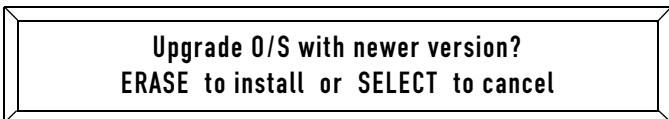
If the message “**Press RECORD to copy O/S**” does not appear on the LCD display, see the explanation below:

- If there is no card in the RAM card slot, or if the RAM card is not fully inserted, the message appears: “**Card is not inserted.**” Fully insert a RAM card into the slot (but *do not force it* into the slot—turn it over if you feel resistance); the LCD display message changes to: “**Press RECORD to copy O/S.**”
  - If the RAM card’s write-protect switch is turned on, the message appears: “**Card is locked.**” You can unlock the card without removing it from the controller. See the section titled “RAM Card: Write-Protection” on page 7-12.
5. Press the <Record> key to replace the RAM card’s current contents with the controller’s operating system (O/S).
6. After you press the <Record> key, the LCD display appears as shown below:
- 
- mem->card card->mem O/S->CARD  
Are you sure? RECORD=copy, SELECT=cancel
- 7.
7. Press the <Record> key to copy the controller’s operating system (O/S) to the RAM card, or press the <Select> key to cancel without copying.
8. After backing up the operating system, write-protect the RAM card as shown in the section titled “RAM Card: Write-Protection” on page 7-12.

## ***Restoring the Operating System from a RAM Card***

This section describes how to install an operating system from a RAM card to the controller. You should use this procedure if you are installing an updated or replacement (same version) operating system. You can obtain updated operating systems from your High End Systems dealer/distributor.

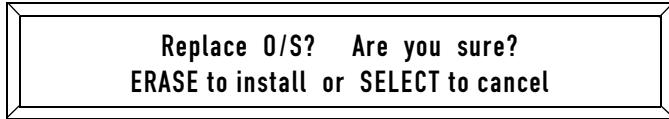
1. Turn OFF the controller.
2. Insert the RAM card with the newer or replacement (same) operating system version into the RAM card slot on the front panel. The RAM card is designed to go in the slot only one way; ***do not force the card into the slot***. If you feel resistance, turn the card over and reinsert it.
3. Turn the controller back ON.
4. The LCD display briefly shows the controller's boot version number and then appears as shown below:



Upgrade O/S with newer version?  
ERASE to install or SELECT to cancel

**Note** If the RAM card has the same operating system version, or if you are restoring a lost operating system, different messages are displayed.

5. The controller waits a short time for you to respond. If you do not press either the <Erase> key or the <Select> key, the controller boots up normally with the existing operating system.
6. Press the <Erase> key to install the newer version of the operating system. The LCD display then appears as shown below:



Replace O/S? Are you sure?  
ERASE to install or SELECT to cancel

7. Press the <Erase> key again to continue, or press the <Select> key to cancel. If you press the <Erase> key, the LCD display appears as shown below:

Erasing the flash ROM. DO NOT Interrupt!

Copying ramcard to Flash ROM. Do NOT interrupt!



**Caution** Do not turn controller power off while the RAM card is transferring information. If you want to repeat the operation, wait until it is completed and then turn the controller's power off.

8. When the copying is finished the LCD display appears as shown below:

Copy complete. Turn power off, remove ramcard, and power on to continue.

9. Turn the controller OFF, remove the RAM card and put it in a safe place.
10. Turn power back ON to continue with the updated operating system.
11. Write-protect the RAM card as shown in the next section.

# **RAM Card: Write-Protection**

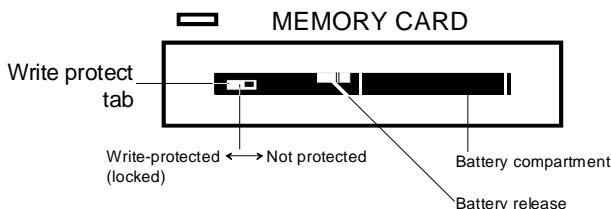
---

After backing up either the operating system or memory to the RAM card, you should write-protect that card to prevent it from being inadvertently erased.

Examine the end of your RAM card to locate the small write-protect tab. Also note the battery release, typically located near the battery compartment. *Do not disengage the battery release, since that could cause the battery to fall out of the RAM card.*

**Note** Figure 7-1 below shows the RAM card shipped with the Studio Color LCD controller (part number 80440017). Because of the wide variety of compatible RAM cards available, you should consult the documentation provided with your RAM card if you are unsure of the location of its components.

Figure 7-1 shows the locations of the write-protect tab and the battery release on the RAM card that is being shipped with the Studio Color LCD controller at the time of this writing:



*Figure 7-1. Slide the write-protect bar to the right to allow the RAM card to accept data, or move it to the left to prevent it from accepting data.*

# ***IBM-Compatible***

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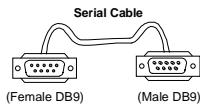
This section describes how to back up and restore the controller's pages, memories and presets using an IBM-compatible personal computer. See also:

- “RAM Card: Memory” on page 7-4
- “Crossloading” on page 7-30
- “Macintosh” on page 7-24

## ***Hardware/Software Requirements***

Hard or floppy disk with at least 260KB of available space; one floppy drive (or two if you want to backup/restore to or from a floppy); an RS-232C serial communication port; and a standard serial communication cable. Backup software is included.

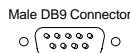
## ***Serial Communication Cable***



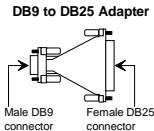
You will need a standard serial communication cable with one male DB9 end (for the controller) and a female end matching the free serial communication port on your computer.



- There are two types of serial ports: DB9 (9-pin) and DB25 (25-pin). Use the documentation provided with your computer to determine whether its serial port is DB9 or DB25.



- If your computer's serial port is DB9, obtain a serial cable with one male DB9 end and one female DB9 end.
- If your computer's serial port is DB25, obtain a serial cable with one male DB9 end and one female DB25 end.

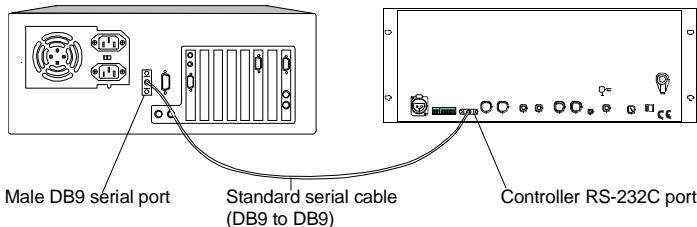


You can use a DB9 to DB25 adapter if the female end of your serial cable does not match your computer's serial port. *Make sure you do not use a null modem adapter*, since that will prevent the controller from communicating with your computer.

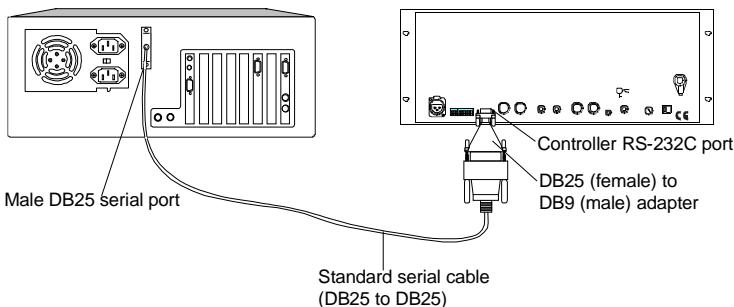
## ***Connecting the Computer and Controller***

Figure 7-2 shows two different connections. The top diagram shows how to connect a PC with a DB9 serial port to the controller using a standard DB9-to-DB9 cable. The bottom diagram shows how to connect a PC with a DB25 serial port to the controller using a standard DB25-to-DB25 cable and a DB25-to-DB9 adapter:

**Computer with DB9 serial port**



**Computer with DB25 serial port**



*Figure 7-2. Connecting PCs with either a DB9 or a DB25 serial port to the controller for download/upload.*

## ***Initial Setup***

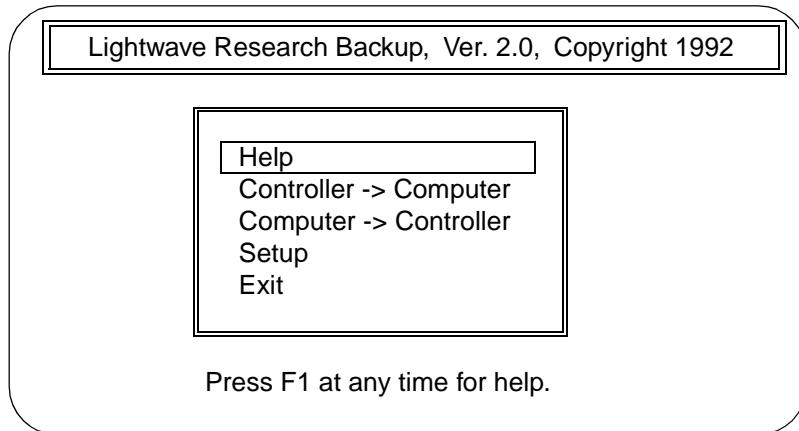
You must follow the procedure below backing up controller memory to a personal computer, or restoring pages, memories and presets from a personal computer to the controller.

1. Toggle the controller's <Standby> key until the Standby LED comes ON.
2. If you are currently running Windows, exit to a DOS prompt.
3. Insert the backup diskette shipped with the controller into your computer's floppy diskette drive. Type one of the following commands, followed by <Enter>:

**A:LWBACKUP**

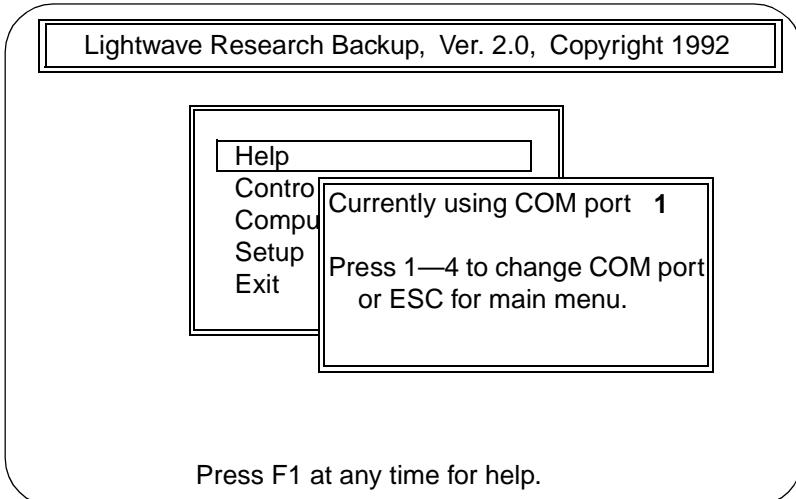
**B:LWBACKUP**

4. If an error message appears notifying you that a serial port cannot be accessed, select the "Ignore" option to continue.
5. The Lightwave Research Backup main menu then appears:



*Figure 7-3. Lightwave Research Backup main menu.*

6. The menu shows the currently-selected option in reverse video; in Figure 7-3, the selected option is **Help**.
7. Use your computer's <Up> and <Down> arrow keys to select **Setup** and press <Enter>.
8. The Setup pop-up menu prompts you to select a COM (or serial communication port) for the backup program to use.



*Figure 7-4. Selecting a COM (serial communication) port to use.*

9. When you start the backup program, it always defaults to COM 1 (serial communication port 1). Typically, Windows uses COM 1 for the mouse so you would need to select another serial port for the backup.

To use another serial port for backing up or restoring the controller's memory, type in the number, from 1—4, of that port. After entering a port number, press <Enter>.

For example, to use COM 3, type **3** and <Enter>.



**Caution** **Entering an incorrect COM port will prevent data from being transferred. Consult your computer's documentation to confirm the COM port.**

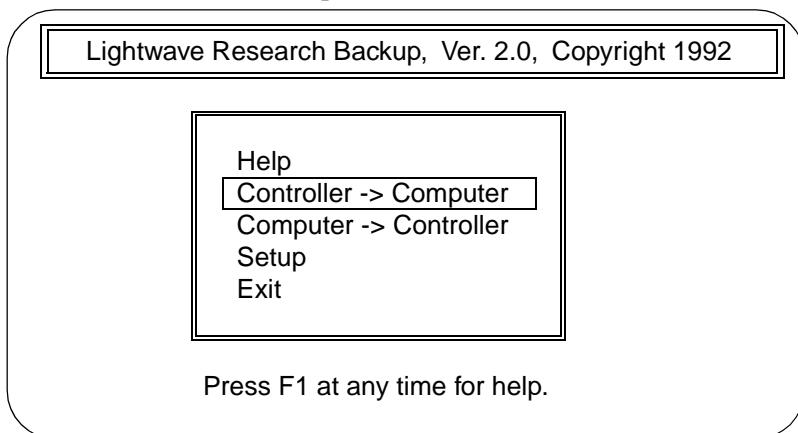
10. Now see one of the following sections:

- “Backing Up (Downloading) Memory to the Computer” on page 7-17
- “Restoring (Uploading) Memory from Computer to Controller” on page 7-20

## ***Backing Up (Downloading) Memory to the Computer***

Before following this procedure, you must have already followed the instructions in the following sections:

- “Connecting the Computer and Controller” on page 7-14
  - “Initial Setup” on page 7-15
1. Use the <Up> and <Down> arrow keys to select the **Controller->Computer** option from the main menu, as shown below, then press <Enter>.



7

*Figure 7-5. The Controller->Computer option backs up (downloads) memory from the controller to your computer.*

2. The next menu gives you the following options which are available throughout the rest of the procedure. Use your computer's <Up> and <Down> arrow keys to select an option and press <Enter>.
  - Current directory: the top of the menu displays the current drive and directory (by default, **C:\**).
  - **>>>NEW FILE<<<**: Create a new file to back up to. This file will be located in the current directory.
  - **>>>CHANGE DRIVE<<<**: Locate the backup file on a different hard or floppy drive. Type the letter of the drive you want to store the file on (**C**, **D**, etc.).
  - **>>>PREVIOUS DIRECTORY<<<**: Go up one level in the directory structure.
  - List of directories on the current drive: A list of the directories on the current drive (by default, **C:\**) is displayed. Use your computer's <Up> and <Down> arrow keys to select a directory and press <Enter>.
3. First, select a drive to store the backup file on. The current drive is displayed at the top of the menu (by default, **C:\**). Use the options shown in Step 2 to change the drive, if necessary.
4. Now select a directory on the drive you selected in the previous step. Use the options shown in Step 2 to change the directory, if necessary.
5. Once you have selected a drive and directory, all files in the directory are displayed. Do one of the following:
  - To back up to the same file as you previously used (overwriting the file), use the <Up> and <Down> arrow keys to select the file and press <Enter>.
  - To back up to a new file, use the <Up> and <Down> arrow keys to select **>>>NEW FILE<<<** and press <Enter>. You will be prompted to type in a file name, followed by <Enter>.

6. Press and hold the <Record> key (about 10 seconds) on the controller's front panel until the LCD display shows the following message:

Download to RS-232 port. Prepare to  
receive ASCII file, then press RECORD

7. The Lightwave Research Backup menu should now display an identical message.
  - If so, press **Y** on your computer's keyboard.
  - If not, you have not selected a file to store the backup. Repeat the previous steps.
8. The next menu shows which drive, directory and file you will back up to.
  - If the displayed information is correct, press the <Record> key on the controller's front panel to begin the download.
  - If the displayed information is incorrect, press <ESC> on your computer and start the procedure over.
9. The controller's LCD display appears similar to the following while the download is taking place. The controller backs up every page of every memory, including unprogrammed pages and all locked memories:

Download to RS-232 port.  
sending M: x P:xx

7

**Note** To stop the download at any time, press the <ESC> key on your computer's keyboard, then press the <Select> key on the controller's front panel.

10. The controller display returns to normal and a message is displayed on the Lightwave Backup software menu when the transfer is complete.

## **Verifying the Transfer**

Make sure the memory was backed up properly using either Windows File Manager (or Explorer) or the DOS **dir** command. The file should be about 256KB in size. If so, you are finished.

If the file is smaller than 256KB, some problem occurred during the transfer. Follow the troubleshooting suggestions below:

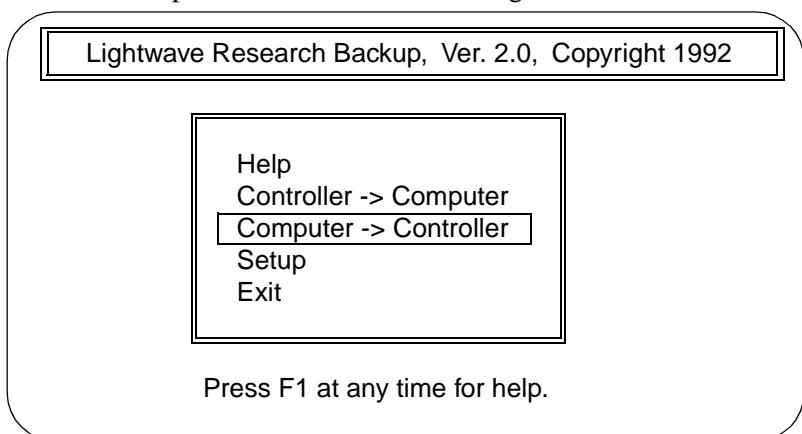
- If the file was larger than 0KB but less than 256KB, the most likely cause was that something interrupted the transfer. Check the cable connections on both ends, verify the cable or replace it with a known working cable. Begin again with the section titled “Initial Setup” on page 7-15, making sure you *do not* press either the <ESC> key on your computer or the <Select> key on the controller until the transfer is complete.
- If the file was 0KB, the most likely reason is you selected the wrong serial (COM) port. You should also check the cable connections on both ends, verify the cable or replace it with a known working cable. Begin again with the section titled “Initial Setup” on page 7-15, making sure you select the correct COM port.

## ***Restoring (Uploading) Memory from Computer to Controller***

Before following this procedure, you must have already followed the instructions in the following sections:

- “Connecting the Computer and Controller” on page 7-14
- “Initial Setup” on page 7-15

1. Use your computer's <Up> and <Down> arrow keys to select **Computer->Controller** from the Lightwave Research Backup main menu, as shown in Figure 7-6:



*Figure 7-6. Restoring memory from a file stored on a computer to the controller.*

2. The next menu gives you the following options which are available throughout the rest of the procedure. Use your computer's <Up> and <Down> arrow keys to select an option and press <Enter>.
  - Current directory: the top of the menu displays the current drive and directory (by default, **C:\**).
  - **>>>NEW FILE<<<**: Create a new file to back up to. This file will be located in the current directory.
  - **>>>CHANGE DRIVE<<<**: Locate the backup file on a different hard or floppy drive. Type the letter of the drive you want to store the file on (**C**, **D**, etc.).
  - **>>>PREVIOUS DIRECTORY<<<**: Go up one level in the directory structure.
  - List of directories on the current drive: A list of the directories on the current drive (by default, **C:\**) is displayed. Use your computer's <Up> and <Down> arrow keys to select a directory and press <Enter>.

3. First, select the drive where the backup file is located. The current drive is displayed at the top of the menu (by default, C:\). Use the options shown in Step 2 to change the drive, if necessary.
4. Now select a directory on the drive you selected in the previous step. Use the options shown in Step 2 to change the directory, if necessary.
5. Once you have selected a drive and directory, all files in the directory are displayed. Use the <Up> and <Down> arrow keys to select the file to restore (upload) and press <Enter>.
6. Press and hold the <Erase> key (about 10 seconds) on the controller's front panel until the LCD display shows the following message:

Upload from RS-232 port.  
Send file Now, press SELECT when done

7. The Lightwave Research Backup menu should now display an identical message.
  - If so, press Y on your computer's keyboard.
  - If not, you have not selected a file to restore from. Repeat the previous steps.
8. The menu displays a message confirming which drive, directory and file you will back up to.
  - If the displayed information is correct, press your computer's <Enter> key to begin the upload.
  - If the displayed information is incorrect, press <ESC> and start the procedure over.

**Note** To stop the transfer at any time, press the <ESC> key on your computer's keyboard, then press the <Select> key on the controller's front panel. No data corruption will result; stopping the transfer only limits the amount of data you upload.

9. A message is displayed on the Lightwave Backup software menu when the transfer is complete. Press the controller's <Select> key to complete the operation.

## Verifying the Transfer

Make sure the transfer was successful by checking the programming on several pages in different memories you know should have been changed. If the pages are programmed as you expected, you are finished.

If the pages are not programmed as you expected, something interrupted the file transfer. Do all of the following:

- Verify you selected the correct serial (COM) port as described in the section titled “Initial Setup” on page 7-15.
- Check the cable connections on both ends, verify the cable or replace it with a known working cable.
- Repeat the procedure, making sure not to press either your computer’s <ESC> key or the controller’s <Select> key until the transfer has completed.

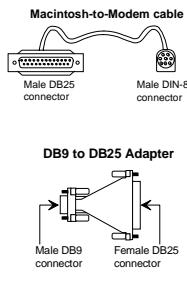
# **Macintosh**

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This section describes how to back up and restore the controller's pages, memories and presets using a Macintosh personal computer. See also:

- “RAM Card: Memory” on page 7-4
- “IBM-Compatible” on page 7-13
- “Crossloading” on page 7-30

## **Hardware/Software Requirements**

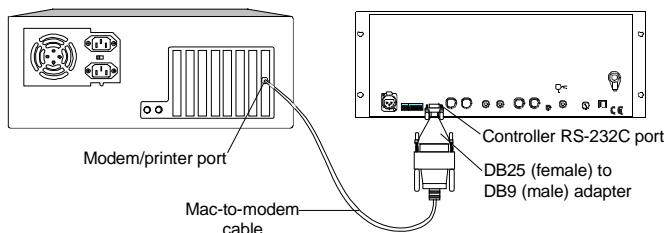


- Hard or floppy drive with at least 260KB available space.
- One Macintosh-to-modem cable (male DIN 8 connector on one end and a male DB25 connector on the other end).
- Female DB25-to-male DB9 adapter (*do not use a null modem adapter* because that will prevent the data from being transferred).
- White Knight™ or any other commercially-available Macintosh communication software. White Knight is recommended, since the procedure that follows is based on White Knight.

## **Connecting the Computer and Controller**

1. Connect the DIN 8 end of the Mac-to-modem cable to your computer's free modem/printer port. If all modem/printer ports are currently being used, you will have to disconnect one port in order to proceed.
2. Connect the male DB9 end of the adapter to the controller's communication port, located on its rear panel.

3. Connect the Mac-to-modem cable to the DB25 end of the adapter. See Figure 7-7:



*Figure 7-7. Connecting a Macintosh to the controller for download/upload.*

## **Setting Up the Software**

You must follow the procedure in this section before either backing up controller memory to your computer, or restoring memory from the computer to the controller.

### **Setup Summary**

The detailed procedure that follows is based on White Knight only; if you have another communication program, make sure you set it for all of the following:

- 9600 baud
- 8 data bits, 1 stop bit
- Ignore parity
- Full duplex
- VT100 terminal emulation

7

### **White Knight v11.14 Setup Procedure**

The procedure that follows is based on White Knight v11.14. Consult the documentation provided with your copy of White Knight if you are using a different version.

Make sure you have already connected the cabling as

described in the section titled “Connecting the Computer and Controller” on page 7-24.

1. Start White Knight. Press **Command+U** to open the Serial Port Settings dialog box and set the serial port for all of the following:
  - Serial port type: **Modem** (click the telephone icon)
  - Baud rate: **9600**
  - Parity: **Ignore**
  - Databits: **8**
  - Stopbits: **1**
  - Duplex: **Full**
2. Click **OK** to accept the serial port settings.
3. Press **Command+O+E** to open the Emulation Options dialog box and set the following:
  - Terminal Emulation: **VT100**
  - Pre-Emulation filter and Post-Emulation filter: make sure both filters are off as indicated by the absence of an “X” mark in the adjacent boxes.
4. Click **OK** to accept the emulation options.

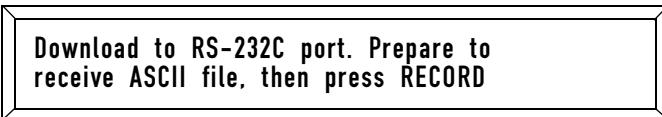
## ***Backing Up (Downloading) Memory from Controller to Computer***

The procedure that follows is based on White Knight v11.14. Consult the documentation provided with your copy of White Knight if you are using a different version.

Make sure you followed the procedure in both the following sections before continuing:

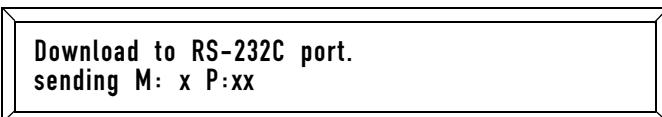
- “Connecting the Computer and Controller” on page 7-24
- “Setting Up the Software” on page 7-25

1. Toggle the <Standby> key on the controller's front panel until the Standby LED turns ON.
2. Press and hold the <Record> key on the controller's front panel until the LCD display appears as shown below:



3. Your computer screen should display the following message:

**Save from controller to PC.  
Set PC to receive, then press RECORD to begin.  
Press SELECT to quit anytime.**
4. On your computer, press **Command+F+N** to start the file capture. Enter a file name in the Capture File to Save text field and click **Save**.
5. Press the <Record> key on the controller's front panel to start the transfer. The controller's LCD display appears as shown below while the transfer is taking place:



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**Note** If you use White Knight, at the bottom of your screen you will see a long series of characters that increments as data is being sent. This is normal.

6. The controller's LCD display returns to normal when the transfer is complete. Press the <Select> key on the controller's front panel to stop the download.
7. Press **Command+F+C** on your computer to end the file capture.

## **Verifying the Transfer**

Open the Get Info window on the file you just captured to make sure the file is about 256KB in size. If the file was 256KB, you are finished.

- If the file was larger than 0KB but less than 256KB, the most likely cause was that something interrupted the transfer. Check the cable connections on both ends, verify the cable or replace it with a known working cable. Begin again with the section titled “Setting Up the Software” on page 7-25, making sure you do not press the <Select> key on the controller or close the file capture until the transfer is complete.
- If the file was 0KB, the most likely reason is a faulty cable or connection. Check the cable connections on both ends, verify the cable or replace it with a known working cable. Begin again with the section titled “Setting Up the Software” on page 7-25.

## ***Restoring (Uploading) Memory from Computer to Controller***

Make sure you followed the procedure in both the following sections before continuing:

- “Connecting the Computer and Controller” on page 7-24
  - “Setting Up the Software” on page 7-25
1. Press and hold down the <Erase> key on the controller’s front panel (about 10 seconds) until its LCD display shows the following:

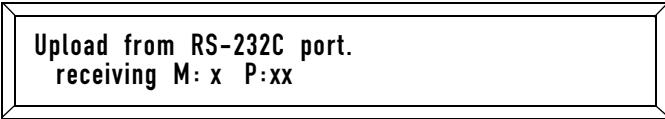


Upload from RS-232C port.  
Send file Now, press SELECT when done

2. Your computer screen should display the following message:

**Restore to controller from PC.  
Send data to controller now.  
Press SELECT to quit anytime.**

3. Press **Command+Y** to send a text file. Use the Please Select A File dialog box to locate the file containing backed-up memory, then click **Select** to start the upload.
4. While the upload is underway, the controller's LCD display appears as shown below:



Upload from RS-232C port.  
receiving M: x P:xx

- Note** You can press the <Select> key on the controller's front panel at any time to stop the transfer.
5. The controller's LCD display shows the following when the transfer is complete:



Upload from RS-232C port.  
receiving M: 9 P: \*\*

7

6. Press the controller's <Select> key to complete the operation.

## Verifying the Transfer

Make sure the transfer was successful by checking the programming on several pages in different memories you know should have been changed. If the pages are programmed as you expected, you are finished.

If the pages are not programmed as you expected, first open the Get Info window on the backup file. If the file was less than 256KB in size, it did not contain all of the controller's memories and pages. Check both of the following:

- Check the cable connections on both ends, verify the cable or replace it with a known working cable.
- Repeat the procedure, making sure not to press the <Select> key on the controller until the transfer is complete.

## ***Crossloading***

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This section explains how to transfer memories, pages and presets directly from one controller to another controller. The first controller (the *source* controller) will transfer all of its memory to the second (*destination*) controller. The memory of the source controller will not be affected by the transfer.

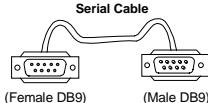
Any locked memories on the destination controller will remain intact; they will not be overwritten.

**Note** Because of the differences between LCD controllers, you should use this procedure only to crossload between two Studio Color LCD controllers.

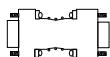
## ***Required Hardware***

One DB9 male-to-DB9 male null modem cable. See Appendix C for pinouts. If you have this cable, you do not need the other materials listed on the next page.

If you do *not* have a null modem cable, you will need the following (see Figure 7-8 on page 7-31):



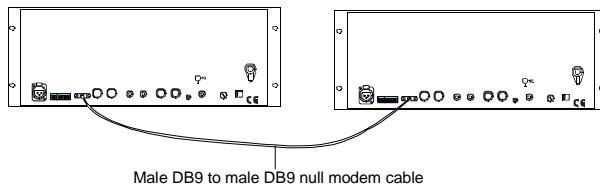
- One standard DB9 female-to-DB9 male serial cable.
- One DB9 male-to-DB9 male null modem adapter, or both of the following:
  - One DB9 male-to-DB9 female null modem adapter
  - One DB9 male-to-DB9 male gender changer



**Note** A gender changer looks exactly like a null modem adapter. It would be a good idea to label them so you don't get them confused later.

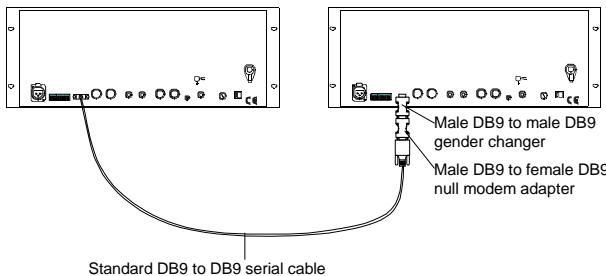
The top diagram in Figure 7-8 shows the simplest connection, using a male DB9-to-male DB9 null modem cable. This type of cable is probably *not* commonly available. The bottom diagram shows a connection using standard, off-the-shelf cabling and adapters:

#### Using a customized null modem cable



7

#### Using standard cables and adapters



*Figure 7-8. Two ways to interconnect controllers to crossload memory.*

Consult Appendix C for a complete selection of cabling and connector wiring diagrams.

## Crossload Procedure

The *source* controller is the one you want to transfer data *from*; the *destination* controller is the one you want to transfer data *to*.

1. Toggle the <Standby> keys on each controller until their Standby LEDs come ON.
2. Press and hold the <Record> key on the source controller (about 10 seconds) until its LCD display shows the following:

Download to RS-232C port. Prepare to receive ASCII file, then press RECORD

3. Press and hold the <Erase> key on the destination controller (about 10 seconds) until its LCD display shows the following:

Upload from RS-232C port.  
Send file Now, press SELECT when done

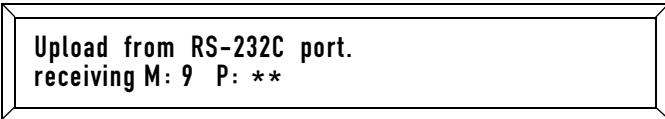
4. Press the <Record> key on the source controller to start the transfer. While the transfer is taking place, the LCD display on the destination controller appears similar to the one shown below:

Download to RS-232C port.  
sending M: x P:xx

**Note** Press the <Select> key on each controller (in any order) at any time to stop the transfer. No data corruption will result; stopping the transfer only limits

the amount of data you crossload.

5. The LCD display of the destination controller shows the following when the transfer is complete:



Upload from RS-232C port.  
receiving M: 9 P: \*\*

6. Restart the destination controller.

## Verifying the Transfer

Make sure the transfer was successful by checking the programming on several pages in different memories you know should have been changed. If the pages were programmed as you expected, you are finished.

If the pages were not programmed as you expected, something interrupted the file transfer. Do both of the following:

- Check all cable and adapters to make sure they are firmly attached, verify the cable or replace it with a known working cable.
- Repeat the procedure, making sure not to press either controller's <Select> key until the transfer has completed.



# Glossary

## Access Modes

The controller offers the following two remote access modes:

- **Page access:** An attached analog controller accesses pages in memory. See Chapter 6 for more information.
- **Preset access:** An attached analog controller access presets, either by 12-level preset access or binary preset access as described in Chapter 6.

## Address Mode



A mode of the controller that allows you to directly access fixtures for programming pages. The Address LED on the <Address>/<Preset> key is ON to indicate the controller is in this mode.

## Advance Modes

The controller offers the following four ways to advance the pages in memory:

- **Manual advance:** Use the Page <Up> and <Down> arrow keys to manually advance through pages in memory.
- **Auto advance:** Pressing the <Auto> key on the controller's front panel causes pages to advance sequentially at the rate determined by the Delay construct and the <Rate> knob. This is the way to play back loops.
- **Audio advance:** Vary the rate of page advance; stop page advance; and modulate color and dim changes using an external audio source. See Chapter 6 for more information.
- **Random advance:** When used with auto advance (and optionally all-memory playback), sequences through initialized (programmed) pages in random order.

## **All-Memory Playback**

When used with auto advance, allows you to play back all 99 pages in all nine memories. (Only initialized, or programmed, pages will play back.) If used with random advance, pages play back in random order.

## **Beam Shaping**

A unique feature of the Studio Color fixture that allows you to align the beam horizontally or vertically. Beam shaping (along with one other special effect) is controlled by the Lens 1 and Lens 2 constructs; see Chapter 3 for more information.

## **Binary Preset Access**

See “Presets”.

## **Blackout**

See “Standby”.

## **Blackout Page**

A page that is erased or reset to its default parameters (with the shutter closed). A blackout page is still an initialized page.

## **Chase**

See “Loop”.

## **Constructs**

Fixture features; for example, Color, Lens 1, Lens 2, Dim, Speed, Crossfade, Position, and so on. When you program the controller you record pages with construct parameters (values).

The meanings of individual constructs are given in Chapter 3. Appendix B has a complete listing of constructs and parameters.

## Crossloading

Transferring memories, pages and presets directly from one controller to another. Also refers to transferring firmware from one Studio Color fixture to other fixtures on the same DMX link. See Chapter 7 for more information about crossloading between controllers. See the *Studio Color User Manual* for information about crossloading firmware between fixtures.

## Delay Time

The value of the Delay parameter, which determines how long one page in a loop “plays” before moving on to the next page in the loop. For example, selecting 2.0 seconds for the Delay construct equates to a *delay time* of 2.0 seconds. The delay time is affected by the <Rate> knob as described in the section titled “Setting Rate and Delay Time” on page 4-18.

## Dichroic filters

A *dichroic* (from Greek, meaning “two-color”) filter achieves a richly-saturated color without using any pigmented (colored) materials. In simple terms, it achieves this effect by either reflecting or “cancelling out” through destructive interference all but a narrow range of the light spectrum.

The “dichroic” name refers to the fact that one color (or set of colors) is reflected or cancelled out, and one color is allowed to be transmitted through the dichroic filter.

The dichroics used in Studio Color are all manufactured at the High End Systems Optical Coating and Assembly Laboratory in Austin, Texas. They are made from a base of Pyrex®-like glass material coated with multiple, microscopic layers of specialized materials separated by junctions that either transmit or reflect certain wavelengths of light, accounting for the resulting color.

Dichroic filters offer a number of advantages over traditional gel filters: since they are made of Pyrex-like glass and absorb almost no heat themselves, they theoretically have no failure mechanism; they transmit more light than gels; and their

resultant colors are more richly-saturated than is possible with a gel.

Dichroics are currently used for all Studio Color color mixing wheels and the color wheel dichroic filters. Before installing a dichroic in Studio Color, make sure you read the *Studio Color User Manual*.

## **Dim**

The brightness of light emitted by the fixture. Gradual dimming is controlled by a mechanical iris, as opposed to the shutter, which is used for quick blackouts as well as strobing.

See also “Master Dim”.

## **DMX 512**

DMX 512 is a standard method of controlling lighting fixtures and other devices (such as lasers and hazers). Developed by the United States Institute of Theatre Technology (USITT), DMX 512 is supported by leading entertainment industry equipment manufacturers, such as High End Systems, Inc.

DMX 512 (*D* for *digital*, *MX* for *multiplex* and *512* is the number of channels per link) is a reliable, efficient and well-understood method of controlling lighting devices. Its strength lies in the ability to control a large number of different types of devices made by various vendors on the same link using any DMX-compatible controller.

## **Dongle**

See “Studio Color Upload Module”.

## **Fixture**

A generic term that describes a wide variety of lighting devices, including automated luminaries like Studio Color.

## **Fixture Number**

(Called *address* by some LCD controllers.) A unique number, 1 through 8, that you assign to each fixture connected to the controller. (The terms *address* and *fixture* are basically interchangeable.) You use the fixture number to program each fixture uniquely. More than one fixture can be assigned to the same address as long as you want those fixtures (addresses) to respond to the same set of constructs in exactly the same way.

## **Gate**

The construct that controls whether the fixture's shutter is open or closed. It also selects the method and the rate of shutter strobing.

See also "Dim" and "Shutter".

## **Homing**

A function of a fixture that returns its constructs to known or default states (defined as their *home positions*).

## **Lightwave Show Control**

Used with Lightwave Control Center software. See the section titled "Lightwave Control Center" on page 6-31 for more information.

See also "Show Control".

## **Link**

(Also called *daisy chain*.) A DMX 512 *link* is a logical bus (serial) connection between devices. A link can connect one controller to many fixtures, or it can interconnect controllers via their Master and Slave ports.

For example, Figure 2-13 on page 2-18 shows two different types of links: each controller connected to fixtures represents one link (for a total of three links in the figure) and the Master/Slave connections between controllers counts as a separate link.

Each DMX 512 link can have up to 32 devices or span 500 ft (153 m). A serial data distributor must be used to extend any link beyond those limits.

See also “DMX 512” and “Serial Data Distributor”.

## **Look**

See “Page”.

## **Loop**

A sequence or series of programmed pages that repeats continuously until you stop it.

## **Luminaire**

See “Fixture”.

## **Macro**

A series of up to 256 keystrokes you can assign to one of the User keys for one-touch playback. For more information, see Chapter 6.

## **Master**

The *master controller* determines the playback of all controllers and fixtures connected to it. Using master/slave controllers is one way of expanding your system beyond eight independently-functioning fixtures.

See also “Slave”.

## **Master Dim**

A setting for fixture intensity (dim) that affects all connected fixtures. Master dim can be set in one of the following ways:

- By setting the Intensity value on the controller's front panel.
- By a submaster as described in the section titled "Submasters" on page 6-23.
- By a master controller as described in the section titled "Switch B-6: Dependent/Independent Presets" on page 2-7.
- Using channel 11 (blackout) in binary preset access as described in the section titled "Using Binary Preset Access" on page 6-21.

## **Memory**

The controller's internal storage space, consisting of: the 891 programmable pages (99 pages in each of 9 memories); presets; User key definitions; submaster definitions; and menu choices.

See also "Page".

## **MIDI**

Musical Instrument Digital Interface. MIDI is the communications protocol for nearly every microprocessor-based musical instrument.

## **MIDI Show Control (MSC)**

A subset of the MIDI specification. See "Show Control".

## **Mirror Mode**

After backing up or restoring user memory using a RAM card, subsequent programming is recorded to both the RAM card and to user memory. See Chapter 7 for details of RAM card usage.

See also "Memory" and "RAM Card".

## **Non-initialized Page**

See “Un-initialized Page”.

## **Page**

The basic programming unit, consisting of addresses (fixtures), constructs and their parameters (values). The controller’s memory can contain up to 891 pages—99 pages in each of 9 memories.

## **Page Access**

See “Access”.

## **Parameter**

The value you assign to a construct. For example, selecting a parameter (value) of 99 for the Dim construct causes the fixture to project a beam of maximum brightness. Appendix B has a complete listing of constructs and parameters.

## **PCMCIA, PC Card**

PCMCIA stands for Personal Computer Memory Card International Association. The official name of adapters that comply with standards issued by the PCMCIA is now *PC Card*.

See “RAM Card”.

## **Position Memory**

(Also called *preset focus* or *preset positioning*.) Allows one page to refer to another page for pan and tilt (position) information. When you alter the reference page, all pages that refer to it reflect the change.

Memory 9 is designated as “position memory.” You can program all 99 pages as position presets, and you can still use all pages in memory 9 not reserved for position presets for page programming.

See the section titled “Using Position Presets” on page 6-3 for more information.

## Preset Access

See “Access Modes”.

## Preset Banking

Allows you to access up to 1024 presets from the controller’s front panel. The controller has 128 banks of presets; each of the 8 Preset keys can be used as a separate preset in each bank for a total of 1024 presets.

Preset bank 1 contains presets 1 through 8, which directly correspond to the Preset keys. Preset bank 2 contains presets 9 through 16 (the Preset <1> key corresponds to preset 9, the Preset <2> key corresponds to preset 10, and so on)

## Preset Focus

See “Position Memory”.

## Preset Levels

A group of eight presets used with 12-level preset access; see Chapter 6 for more information.

## Preset Mode



Play back loops or individual pages you recorded as presets. The Preset LED on the <Address>/<Preset> key is ON to indicate the controller is in this mode.

See Chapter 6 for more information about 12-level or binary preset access.

## Preset Positioning

See “Position Memory”.

## Presets

A programmed page or loop assigned to a Preset key for one-touch playback. Presets can also be recorded and played back in 12-level and binary access modes. Presets are covered in Chapter 4; preset access is covered in Chapter 6.

See also “Preset Levels”, “Access” and “Preset Mode”.

## **RAM Card**

Another name for a PC Card (*nee* PCMCIA, Personal Computer Memory Card International Association). The Studio Color LCD controller uses a Type 1, 256KB SRAM PC Card. The RAM card provides you with the means to backup or store the controller's memory in a removable device. You can then restore the controller's memory to the same or other controllers.

See also "PCMCIA".

## **Remote Enable**

The controller's Remote Enable connector that allows you to remotely enable and disable the controller as described below:

- Sending a voltage of 0 V DC disables the controller (all fixtures go dark, all wheels stop moving, and all in-progress moves finish immediately).
- Sending a voltage between +5 V to +16 V DC to returns the controller to its previous state. If the controller was previously in Standby (with the Standby LED ON), the controller returns to Standby; if the controller was *not* previously in Standby, the controller resumes operation.

## **Scene**

See "Page".

## **Sequence**

See "Loop".

## **Serial Data Distributor**

A device used to retime and regenerate the DMX 512 signal in order to extend your cable run. A serial data distributor is required whenever either of the following is true:

- You wish to connect more than 32 fixtures to a controller (or more than 32 controllers together) on a single link.

- The end-to-end cable span (the total length of all cables) on any link exceeds 500 ft. (153 m).

See also “Link”.

## Show Control

A protocol (language) that allows a variety of different types of devices to be controlled from a central source, such as a lighting console. Typically, a show control protocol will allow you to set up cue lists on a lighting console that play back pages or presets on any controller connected to it.

Show control protocols differ from the DMX 512 protocol in that DMX 512 is typically used to control devices such as lighting fixtures.

The two types of show control protocols covered in this manual are MIDI Show Control (MSC) and Lightwave Show Control (LSC). See Chapter 5 for more information.

## Shutter

The Studio Color fixture has a mechanical shutter that is used to black the fixture out quickly as well as for strobing using the Gate construct.

See also “Dim” and “Gate”.

## Slave

A *slave* or *slaved controller* accepts all of its playback commands from the master controller. All programming is done on the slaved controller, however.

See also “Master”.

## SRAM

Static Random Access Memory. The type of memory used for backup and restore functions using a RAM card.

See also “RAM card”.

## **Standby**

In Standby, all fixtures' shutters close and any in-progress wheel or effect changes stop immediately. Controller pages continue to advance in Standby, however.

You can put the controller into Standby by pressing the <Standby> key on the controller's front panel.

See also "Remote Enable".

## **Studio Color Upload Module**

(Also called a *dongle*.) Allows you to upgrade firmware to Studio Color fixtures across a DMX 512 link. All you need is a computer with an available parallel port and keyboard connector. Contact your High End Systems dealer/distributor for more information (part number 26040002).

Studio Color fixtures need to be running firmware version 38C or later in order to take full advantage of available constructs. The section titled "Verifying the Firmware Version" on page 2-9 explains how to check the firmware version.

## **Submaster**

A *submaster* is an analog 0-10 V controller you can use to remotely adjust (override), in real time, the dim, color, and gobo construct parameters for selected fixtures. You can define up to 12 submasters and control them using one or more analog controllers.

## **Tip/Ring connector**

The type of connector typically used for monaural audio sources. A connector of this type is shown in Figure 6-6 on page 6-30.

## **Tip/Ring/Sleeve connector**

The type of connector typically used for stereo audio sources. This type of connector is diagrammed above the Stereo Audio Input port located on the controller's rear panel.

## **Twelve-Level Preset Access**

See “Presets”.

## **Un-initialized Page**

An un-initialized page acts as a “placeholder” to indicate the beginning and end of a chase or loop.

## **User-Defined Keys**

These eight keys allow you to access the five audio advance modes or to record and play back custom macros.

See also “Advance Modes” and “Macro”.

## **User Memory**

See “Memory”.



# **Appendix A**

## **Binary Access Table**

The binary values listed in Table A-1 equate to the first 10 channels of analog input channels 1 to 12, with the least significant binary bit being channel 1. You can use Table A-1 as shown below:

- Determining which analog controller channels to enable and disable when you are using binary preset access. See “Using Binary Preset Access” on page A-2.
- Determining which Studio Color LCD controller Preset LED will be ON for a preset selected using binary preset access.

### ***Explanation of the Table***

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Table A-1 has a total of 13 columns with the meanings explained below:

- **Preset No.:** Lists preset numbers sequentially from 1 to 1023.
- **Preset Key:** Shows which Preset LED will be ON for the selected preset in binary preset access. For example, if you use preset 600 in binary preset access, the preset <8> LED will be ON.
- **Preset Level:** Each group of eight presets counts as one level. For example, preset numbers 1—8 are in preset level 1; preset numbers 9—16 are in preset level 2, etc. The first 12 preset levels (presets 1—96) are used in 12-level preset access mode and the remaining preset levels are listed for your information.
- **Analog Controller Channel Number:** A group of 10 columns that give the binary equivalent of the preset number. To use that number, enable analog controller

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channels corresponding to binary 1s and disable channels corresponding to binary 0s. For more details, see the next section.

## ***Using Binary Preset Access***

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1. Choose a preset number.
2. Note the numbers listed in the group of 10 columns under the heading “Analog Controller Channel Number”; this is the 10-digit binary equivalent of the preset number you selected.
3. Enable channels on your controller corresponding to binary 1’s and disable channels corresponding to binary 0’s. For example, to use preset 1 enable channel 1 but do not enable channels 2—10. To use preset 966, enable channels 2, 3, 7, 8, 9 and 10 but not channels 1, 4, 5 or 6.

**0V = Disabled, 5V-10V = Enabled**

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
1	1	1	1	0	0	0	0	0	0	0	0	0
2	2	1	0	1	0	0	0	0	0	0	0	0
3	3	1	1	1	0	0	0	0	0	0	0	0
4	4	1	0	0	1	0	0	0	0	0	0	0
5	5	1	1	0	1	0	0	0	0	0	0	0
6	6	1	0	1	1	0	0	0	0	0	0	0
7	7	1	1	1	1	0	0	0	0	0	0	0
8	8	1	0	0	0	1	0	0	0	0	0	0
9	1	2	1	0	0	1	0	0	0	0	0	0
10	2	2	0	1	0	1	0	0	0	0	0	0
11	3	2	1	1	0	1	0	0	0	0	0	0

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
12	4	2	0	0	1	1	0	0	0	0	0	0
13	5	2	1	0	1	1	0	0	0	0	0	0
14	6	2	0	1	1	1	0	0	0	0	0	0
15	7	2	1	1	1	1	0	0	0	0	0	0
16	8	2	0	0	0	0	1	0	0	0	0	0
17	1	3	1	0	0	0	1	0	0	0	0	0
18	2	3	0	1	0	0	1	0	0	0	0	0
19	3	3	1	1	0	0	1	0	0	0	0	0
20	4	3	0	0	1	0	1	0	0	0	0	0
21	5	3	1	0	1	0	1	0	0	0	0	0
22	6	3	0	1	1	0	1	0	0	0	0	0
23	7	3	1	1	1	0	1	0	0	0	0	0
24	8	3	0	0	0	1	1	0	0	0	0	0
25	1	4	1	0	0	1	1	0	0	0	0	0
26	2	4	0	1	0	1	1	0	0	0	0	0
27	3	4	1	1	0	1	1	0	0	0	0	0
28	4	4	0	0	1	1	1	0	0	0	0	0
29	5	4	1	0	1	1	1	0	0	0	0	0
30	6	4	0	1	1	1	1	0	0	0	0	0
31	7	4	1	1	1	1	1	0	0	0	0	0
32	8	4	0	0	0	0	0	1	0	0	0	0
33	1	5	1	0	0	0	0	1	0	0	0	0
34	2	5	0	1	0	0	0	1	0	0	0	0
35	3	5	1	1	0	0	0	1	0	0	0	0
36	4	5	0	0	1	0	0	1	0	0	0	0
37	5	5	1	0	1	0	0	1	0	0	0	0
38	6	5	0	1	1	0	0	1	0	0	0	0
39	7	5	1	1	1	0	0	1	0	0	0	0
40	8	5	0	0	0	0	1	0	1	0	0	0
41	1	6	1	0	0	1	0	1	0	0	0	0

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
42	2	6	0	1	0	1	0	1	0	0	0	0
43	3	6	1	1	0	1	0	1	0	0	0	0
44	4	6	0	0	1	1	0	1	0	0	0	0
45	5	6	1	0	1	1	0	1	0	0	0	0
46	6	6	0	1	1	1	0	1	0	0	0	0
47	7	6	1	1	1	1	0	1	0	0	0	0
48	8	6	0	0	0	0	1	1	0	0	0	0
49	1	7	1	0	0	0	1	1	0	0	0	0
50	2	7	0	1	0	0	1	1	0	0	0	0
51	3	7	1	1	0	0	1	1	0	0	0	0
52	4	7	0	0	1	0	1	1	0	0	0	0
53	5	7	1	0	1	0	1	1	0	0	0	0
54	6	7	0	1	1	0	1	1	0	0	0	0
55	7	7	1	1	1	0	1	1	0	0	0	0
56	8	7	0	0	0	1	1	1	0	0	0	0
57	1	8	1	0	0	1	1	1	0	0	0	0
58	2	8	0	1	0	1	1	1	0	0	0	0
59	3	8	1	1	0	1	1	1	0	0	0	0
60	4	8	0	0	1	1	1	1	0	0	0	0
61	5	8	1	0	1	1	1	1	0	0	0	0
62	6	8	0	1	1	1	1	1	0	0	0	0
63	7	8	1	1	1	1	1	1	0	0	0	0
64	8	8	0	0	0	0	0	0	1	0	0	0
65	1	9	1	0	0	0	0	0	1	0	0	0
66	2	9	0	1	0	0	0	0	1	0	0	0
67	3	9	1	1	0	0	0	0	1	0	0	0
68	4	9	0	0	1	0	0	0	1	0	0	0
69	5	9	1	0	1	0	0	0	1	0	0	0
70	6	9	0	1	1	0	0	0	1	0	0	0
71	7	9	1	1	1	0	0	0	1	0	0	0

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
72	8	9	0	0	0	1	0	0	1	0	0	0
73	1	10	1	0	0	1	0	0	1	0	0	0
74	2	10	0	1	0	1	0	0	1	0	0	0
75	3	10	1	1	0	1	0	0	1	0	0	0
76	4	10	0	0	1	1	0	0	1	0	0	0
77	5	10	1	0	1	1	0	0	1	0	0	0
78	6	10	0	1	1	1	0	0	1	0	0	0
79	7	10	1	1	1	1	0	0	1	0	0	0
80	8	10	0	0	0	0	1	0	1	0	0	0
81	1	11	1	0	0	0	1	0	1	0	0	0
82	2	11	0	1	0	0	1	0	1	0	0	0
83	3	11	1	1	0	0	1	0	1	0	0	0
84	4	11	0	0	1	0	1	0	1	0	0	0
85	5	11	1	0	1	0	1	0	1	0	0	0
86	6	11	0	1	1	0	1	0	1	0	0	0
87	7	11	1	1	1	0	1	0	1	0	0	0
88	8	11	0	0	0	1	1	0	1	0	0	0
89	1	12	1	0	0	1	1	0	1	0	0	0
90	2	12	0	1	0	1	1	0	1	0	0	0
91	3	12	1	1	0	1	1	0	1	0	0	0
92	4	12	0	0	1	1	1	0	1	0	0	0
93	5	12	1	0	1	1	1	0	1	0	0	0
94	6	12	0	1	1	1	1	0	1	0	0	0
95	7	12	1	1	1	1	1	0	1	0	0	0
96	8	12	0	0	0	0	0	1	1	0	0	0
97	1	13	1	0	0	0	0	1	1	0	0	0
98	2	13	0	1	0	0	0	1	1	0	0	0
99	3	13	1	1	0	0	0	1	1	0	0	0
100	4	13	0	0	1	0	0	1	1	0	0	0
101	5	13	1	0	1	0	0	1	1	0	0	0

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
102	6	13	0	1	1	0	0	1	1	0	0	0
103	7	13	1	1	1	0	0	1	1	0	0	0
104	8	13	0	0	0	1	0	1	1	0	0	0
105	1	14	1	0	0	1	0	1	1	0	0	0
106	2	14	0	1	0	1	0	1	1	0	0	0
107	3	14	1	1	0	1	0	1	1	0	0	0
108	4	14	0	0	1	1	0	1	1	0	0	0
109	5	14	1	0	1	1	0	1	1	0	0	0
110	6	14	0	1	1	1	0	1	1	0	0	0
111	7	14	1	1	1	1	0	1	1	0	0	0
112	8	14	0	0	0	0	1	1	1	0	0	0
113	1	15	1	0	0	0	1	1	1	0	0	0
114	2	15	0	1	0	0	1	1	1	0	0	0
115	3	15	1	1	0	0	1	1	1	0	0	0
116	4	15	0	0	1	0	1	1	1	0	0	0
117	5	15	1	0	1	0	1	1	1	0	0	0
118	6	15	0	1	1	0	1	1	1	0	0	0
119	7	15	1	1	1	0	1	1	1	0	0	0
120	8	15	0	0	0	1	1	1	1	0	0	0
121	1	16	1	0	0	1	1	1	1	0	0	0
122	2	16	0	1	0	1	1	1	1	0	0	0
123	3	16	1	1	0	1	1	1	1	0	0	0
124	4	16	0	0	1	1	1	1	1	0	0	0
125	5	16	1	0	1	1	1	1	1	0	0	0
126	6	16	0	1	1	1	1	1	1	0	0	0
127	7	16	1	1	1	1	1	1	1	0	0	0
128	8	16	0	0	0	0	0	0	0	1	0	0
129	1	17	1	0	0	0	0	0	0	1	0	0
130	2	17	0	1	0	0	0	0	0	1	0	0
131	3	17	1	1	0	0	0	0	0	1	0	0

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
132	4	17	0	0	1	0	0	0	0	1	0	0
133	5	17	1	0	1	0	0	0	0	1	0	0
134	6	17	0	1	1	0	0	0	0	1	0	0
135	7	17	1	1	1	0	0	0	0	1	0	0
136	8	17	0	0	0	1	0	0	0	1	0	0
137	1	18	1	0	0	1	0	0	0	1	0	0
138	2	18	0	1	0	1	0	0	0	1	0	0
139	3	18	1	1	0	1	0	0	0	1	0	0
140	4	18	0	0	1	1	0	0	0	1	0	0
141	5	18	1	0	1	1	0	0	0	1	0	0
142	6	18	0	1	1	1	0	0	0	1	0	0
143	7	18	1	1	1	1	0	0	0	1	0	0
144	8	18	0	0	0	0	0	1	0	1	0	0
145	1	19	1	0	0	0	1	0	0	1	0	0
146	2	19	0	1	0	0	1	0	0	1	0	0
147	3	19	1	1	0	0	1	0	0	1	0	0
148	4	19	0	0	1	0	1	0	0	1	0	0
149	5	19	1	0	1	0	1	0	0	1	0	0
150	6	19	0	1	1	0	1	0	0	1	0	0
151	7	19	1	1	1	0	1	0	0	1	0	0
152	8	19	0	0	0	1	1	0	0	1	0	0
153	1	20	1	0	0	1	1	0	0	1	0	0
154	2	20	0	1	0	1	1	0	0	1	0	0
155	3	20	1	1	0	1	1	0	0	1	0	0
156	4	20	0	0	1	1	1	0	0	1	0	0
157	5	20	1	0	1	1	1	0	0	1	0	0
158	6	20	0	1	1	1	1	0	0	1	0	0
159	7	20	1	1	1	1	1	0	0	1	0	0
160	8	20	0	0	0	0	0	1	0	1	0	0
161	1	21	1	0	0	0	0	1	0	1	0	0

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
162	2	21	0	1	0	0	0	1	0	1	0	0
163	3	21	1	1	0	0	0	1	0	1	0	0
164	4	21	0	0	1	0	0	1	0	1	0	0
165	5	21	1	0	1	0	0	1	0	1	0	0
166	6	21	0	1	1	0	0	1	0	1	0	0
167	7	21	1	1	1	0	0	1	0	1	0	0
168	8	21	0	0	0	1	0	1	0	1	0	0
169	1	22	1	0	0	1	0	1	0	1	0	0
170	2	22	0	1	0	1	0	1	0	1	0	0
171	3	22	1	1	0	1	0	1	0	1	0	0
172	4	22	0	0	1	1	0	1	0	1	0	0
173	5	22	1	0	1	1	0	1	0	1	0	0
174	6	22	0	1	1	1	0	1	0	1	0	0
175	7	22	1	1	1	1	0	1	0	1	0	0
176	8	22	0	0	0	0	1	1	0	1	0	0
177	1	23	1	0	0	0	1	1	0	1	0	0
178	2	23	0	1	0	0	1	1	0	1	0	0
179	3	23	1	1	0	0	1	1	0	1	0	0
180	4	23	0	0	1	0	1	1	0	1	0	0
181	5	23	1	0	1	0	1	1	0	1	0	0
182	6	23	0	1	1	0	1	1	0	1	0	0
183	7	23	1	1	1	0	1	1	0	1	0	0
184	8	23	0	0	0	1	1	1	0	1	0	0
185	1	24	1	0	0	1	1	1	0	1	0	0
186	2	24	0	1	0	1	1	1	0	1	0	0
187	3	24	1	1	0	1	1	1	0	1	0	0
188	4	24	0	0	1	1	1	1	0	1	0	0
189	5	24	1	0	1	1	1	1	0	1	0	0
190	6	24	0	1	1	1	1	1	0	1	0	0
191	7	24	1	1	1	1	1	1	0	1	0	0

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
192	8	24	0	0	0	0	0	0	1	1	0	0
193	1	25	1	0	0	0	0	0	0	1	1	0
194	2	25	0	1	0	0	0	0	0	1	1	0
195	3	25	1	1	0	0	0	0	0	1	1	0
196	4	25	0	0	1	0	0	0	0	1	1	0
197	5	25	1	0	1	0	0	0	0	1	1	0
198	6	25	0	1	1	0	0	0	0	1	1	0
199	7	25	1	1	1	0	0	0	1	1	0	0
200	8	25	0	0	0	1	0	0	1	1	0	0
201	1	26	1	0	0	1	0	0	0	1	1	0
202	2	26	0	1	0	1	0	0	1	1	0	0
203	3	26	1	1	0	1	0	0	1	1	0	0
204	4	26	0	0	1	1	0	0	1	1	0	0
205	5	26	1	0	1	1	0	0	1	1	0	0
206	6	26	0	1	1	1	0	0	1	1	0	0
207	7	26	1	1	1	1	0	0	1	1	0	0
208	8	26	0	0	0	0	1	0	1	1	0	0
209	1	27	1	0	0	0	1	0	1	1	0	0
210	2	27	0	1	0	0	1	0	1	1	0	0
211	3	27	1	1	0	0	1	0	1	1	0	0
212	4	27	0	0	1	0	1	0	1	1	0	0
213	5	27	1	0	1	0	1	0	1	1	0	0
214	6	27	0	1	1	0	1	0	1	1	0	0
215	7	27	1	1	1	0	1	0	1	1	0	0
216	8	27	0	0	0	1	1	0	1	1	0	0
217	1	28	1	0	0	1	1	0	1	1	0	0
218	2	28	0	1	0	1	1	0	1	1	0	0
219	3	28	1	1	0	1	1	0	1	1	0	0
220	4	28	0	0	1	1	1	0	1	1	0	0
221	5	28	1	0	1	1	1	0	1	1	0	0

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
222	6	28	0	1	1	1	1	0	1	1	0	0
223	7	28	1	1	1	1	1	0	1	1	0	0
224	8	28	0	0	0	0	0	1	1	1	0	0
225	1	29	1	0	0	0	0	1	1	1	0	0
226	2	29	0	1	0	0	0	1	1	1	0	0
227	3	29	1	1	0	0	0	1	1	1	0	0
228	4	29	0	0	1	0	0	1	1	1	0	0
229	5	29	1	0	1	0	0	1	1	1	0	0
230	6	29	0	1	1	0	0	1	1	1	0	0
231	7	29	1	1	1	0	0	1	1	1	0	0
232	8	29	0	0	0	1	0	1	1	1	0	0
233	1	30	1	0	0	1	0	1	1	1	0	0
234	2	30	0	1	0	1	0	1	1	1	0	0
235	3	30	1	1	0	1	0	1	1	1	0	0
236	4	30	0	0	1	1	0	1	1	1	0	0
237	5	30	1	0	1	1	0	1	1	1	0	0
238	6	30	0	1	1	1	0	1	1	1	0	0
239	7	30	1	1	1	1	0	1	1	1	0	0
240	8	30	0	0	0	0	1	1	1	1	0	0
241	1	31	1	0	0	0	1	1	1	1	0	0
242	2	31	0	1	0	0	1	1	1	1	0	0
243	3	31	1	1	0	0	1	1	1	1	0	0
244	4	31	0	0	1	0	1	1	1	1	0	0
245	5	31	1	0	1	0	1	1	1	1	0	0
246	6	31	0	1	1	0	1	1	1	1	0	0
247	7	31	1	1	1	0	1	1	1	1	0	0
248	8	31	0	0	0	1	1	1	1	1	0	0
249	1	32	1	0	0	1	1	1	1	1	0	0
250	2	32	0	1	0	1	1	1	1	1	0	0
251	3	32	1	1	0	1	1	1	1	1	0	0

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
252	4	32	0	0	1	1	1	1	1	1	0	0
253	5	32	1	0	1	1	1	1	1	1	0	0
254	6	32	0	1	1	1	1	1	1	1	0	0
255	7	32	1	1	1	1	1	1	1	1	0	0
256	8	32	0	0	0	0	0	0	0	0	1	0
257	1	33	1	0	0	0	0	0	0	0	1	0
258	2	33	0	1	0	0	0	0	0	0	1	0
259	3	33	1	1	0	0	0	0	0	0	1	0
260	4	33	0	0	1	0	0	0	0	0	1	0
261	5	33	1	0	1	0	0	0	0	0	1	0
262	6	33	0	1	1	0	0	0	0	0	1	0
263	7	33	1	1	1	0	0	0	0	0	1	0
264	8	33	0	0	0	1	0	0	0	0	1	0
265	1	34	1	0	0	1	0	0	0	0	1	0
266	2	34	0	1	0	1	0	0	0	0	1	0
267	3	34	1	1	0	1	0	0	0	0	1	0
268	4	34	0	0	1	1	0	0	0	0	1	0
269	5	34	1	0	1	1	0	0	0	0	1	0
270	6	34	0	1	1	1	0	0	0	0	1	0
271	7	34	1	1	1	1	0	0	0	0	1	0
272	8	34	0	0	0	0	0	1	0	0	1	0
273	1	35	1	0	0	0	1	0	0	0	1	0
274	2	35	0	1	0	0	1	0	0	0	1	0
275	3	35	1	1	0	0	1	0	0	0	1	0
276	4	35	0	0	1	0	1	0	0	0	1	0
277	5	35	1	0	1	0	1	0	0	0	1	0
278	6	35	0	1	1	0	1	0	0	0	1	0
279	7	35	1	1	1	0	1	0	0	0	1	0
280	8	35	0	0	0	1	1	0	0	0	1	0
281	1	36	1	0	0	1	1	0	0	0	1	0

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
282	2	36	0	1	0	1	1	0	0	0	1	0
283	3	36	1	1	0	1	1	0	0	0	1	0
284	4	36	0	0	1	1	1	0	0	0	1	0
285	5	36	1	0	1	1	1	0	0	0	1	0
286	6	36	0	1	1	1	1	0	0	0	1	0
287	7	36	1	1	1	1	1	0	0	0	1	0
288	8	36	0	0	0	0	0	1	0	0	1	0
289	1	37	1	0	0	0	0	1	0	0	1	0
290	2	37	0	1	0	0	0	1	0	0	1	0
291	3	37	1	1	0	0	0	1	0	0	1	0
292	4	37	0	0	1	0	0	1	0	0	1	0
293	5	37	1	0	1	0	0	1	0	0	1	0
294	6	37	0	1	1	0	0	1	0	0	1	0
295	7	37	1	1	1	0	0	1	0	0	1	0
296	8	37	0	0	0	1	0	1	0	0	1	0
297	1	38	1	0	0	1	0	1	0	0	1	0
298	2	38	0	1	0	1	0	1	0	0	1	0
299	3	38	1	1	0	1	0	1	0	0	1	0
300	4	38	0	0	1	1	0	1	0	0	1	0
301	5	38	1	0	1	1	0	1	0	0	1	0
302	6	38	0	1	1	1	0	1	0	0	1	0
303	7	38	1	1	1	1	0	1	0	0	1	0
304	8	38	0	0	0	0	1	1	0	0	1	0
305	1	39	1	0	0	0	1	1	0	0	1	0
306	2	39	0	1	0	0	1	1	0	0	1	0
307	3	39	1	1	0	0	1	1	0	0	1	0
308	4	39	0	0	1	0	1	1	0	0	1	0
309	5	39	1	0	1	0	1	1	0	0	1	0
310	6	39	0	1	1	0	1	1	0	0	1	0
311	7	39	1	1	1	0	1	1	0	0	1	0

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
312	8	39	0	0	0	1	1	1	0	0	1	0
313	1	40	1	0	0	1	1	1	0	0	1	0
314	2	40	0	1	0	1	1	1	0	0	1	0
315	3	40	1	1	0	1	1	1	0	0	1	0
316	4	40	0	0	1	1	1	1	0	0	1	0
317	5	40	1	0	1	1	1	1	0	0	1	0
318	6	40	0	1	1	1	1	1	0	0	1	0
319	7	40	1	1	1	1	1	1	0	0	1	0
320	8	40	0	0	0	0	0	0	1	0	1	0
321	1	41	1	0	0	0	0	0	1	0	1	0
322	2	41	0	1	0	0	0	0	1	0	1	0
323	3	41	1	1	0	0	0	0	1	0	1	0
324	4	41	0	0	1	0	0	0	1	0	1	0
325	5	41	1	0	1	0	0	0	1	0	1	0
326	6	41	0	1	1	0	0	0	1	0	1	0
327	7	41	1	1	1	0	0	0	1	0	1	0
328	8	41	0	0	0	1	0	0	1	0	1	0
329	1	42	1	0	0	1	0	0	1	0	1	0
330	2	42	0	1	0	1	0	0	1	0	1	0
331	3	42	1	1	0	1	0	0	1	0	1	0
332	4	42	0	0	1	1	0	0	1	0	1	0
333	5	42	1	0	1	1	0	0	1	0	1	0
334	6	42	0	1	1	1	0	0	1	0	1	0
335	7	42	1	1	1	1	0	0	1	0	1	0
336	8	42	0	0	0	0	1	0	1	0	1	0
337	1	43	1	0	0	0	1	0	1	0	1	0
338	2	43	0	1	0	0	1	0	1	0	1	0
339	3	43	1	1	0	0	1	0	1	0	1	0
340	4	43	0	0	1	0	1	0	1	0	1	0
341	5	43	1	0	1	0	1	0	1	0	1	0

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
342	6	43	0	1	1	0	1	0	1	0	1	0
343	7	43	1	1	1	0	1	0	1	0	1	0
344	8	43	0	0	0	1	1	0	1	0	1	0
345	1	44	1	0	0	1	1	0	1	0	1	0
346	2	44	0	1	0	1	1	0	1	0	1	0
347	3	44	1	1	0	1	1	0	1	0	1	0
348	4	44	0	0	1	1	1	0	1	0	1	0
349	5	44	1	0	1	1	1	0	1	0	1	0
350	6	44	0	1	1	1	1	0	1	0	1	0
351	7	44	1	1	1	1	1	0	1	0	1	0
352	8	44	0	0	0	0	0	1	1	0	1	0
353	1	45	1	0	0	0	0	1	1	0	1	0
354	2	45	0	1	0	0	0	1	1	0	1	0
355	3	45	1	1	0	0	0	1	1	0	1	0
356	4	45	0	0	1	0	0	1	1	0	1	0
357	5	45	1	0	1	0	0	1	1	0	1	0
358	6	45	0	1	1	0	0	1	1	0	1	0
359	7	45	1	1	1	0	0	1	1	0	1	0
360	8	45	0	0	0	1	0	1	1	0	1	0
361	1	46	1	0	0	1	0	1	1	0	1	0
362	2	46	0	1	0	1	0	1	1	0	1	0
363	3	46	1	1	0	1	0	1	1	0	1	0
364	4	46	0	0	1	1	0	1	1	0	1	0
365	5	46	1	0	1	1	0	1	1	0	1	0
366	6	46	0	1	1	1	0	1	1	0	1	0
367	7	46	1	1	1	1	0	1	1	0	1	0
368	8	46	0	0	0	0	1	1	1	0	1	0
369	1	47	1	0	0	0	1	1	1	0	1	0
370	2	47	0	1	0	0	1	1	1	0	1	0
371	3	47	1	1	0	0	1	1	1	0	1	0

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
372	4	47	0	0	1	0	1	1	1	0	1	0
373	5	47	1	0	1	0	1	1	1	0	1	0
374	6	47	0	1	1	0	1	1	1	0	1	0
375	7	47	1	1	1	0	1	1	1	0	1	0
376	8	47	0	0	0	1	1	1	1	0	1	0
377	1	48	1	0	0	1	1	1	1	0	1	0
378	2	48	0	1	0	1	1	1	1	0	1	0
379	3	48	1	1	0	1	1	1	1	0	1	0
380	4	48	0	0	1	1	1	1	1	0	1	0
381	5	48	1	0	1	1	1	1	1	0	1	0
382	6	48	0	1	1	1	1	1	1	0	1	0
383	7	48	1	1	1	1	1	1	1	0	1	0
384	8	48	0	0	0	0	0	0	0	1	1	0
385	1	49	1	0	0	0	0	0	0	0	1	1
386	2	49	0	1	0	0	0	0	0	0	1	1
387	3	49	1	1	0	0	0	0	0	1	1	0
388	4	49	0	0	1	0	0	0	0	1	1	0
389	5	49	1	0	1	0	0	0	0	1	1	0
390	6	49	0	1	1	0	0	0	0	1	1	0
391	7	49	1	1	1	0	0	0	0	1	1	0
392	8	49	0	0	0	1	0	0	0	1	1	0
393	1	50	1	0	0	1	0	0	0	1	1	0
394	2	50	0	1	0	1	0	0	0	1	1	0
395	3	50	1	1	0	1	0	0	0	1	1	0
396	4	50	0	0	1	1	0	0	0	1	1	0
397	5	50	1	0	1	1	0	0	0	1	1	0
398	6	50	0	1	1	1	0	0	0	1	1	0
399	7	50	1	1	1	1	0	0	0	1	1	0
400	8	50	0	0	0	0	0	1	0	1	1	0
401	1	51	1	0	0	0	1	0	0	1	1	0

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
402	2	51	0	1	0	0	1	0	0	1	1	0
403	3	51	1	1	0	0	1	0	0	1	1	0
404	4	51	0	0	1	0	1	0	0	1	1	0
405	5	51	1	0	1	0	1	0	0	1	1	0
406	6	51	0	1	1	0	1	0	0	1	1	0
407	7	51	1	1	1	0	1	0	0	1	1	0
408	8	51	0	0	0	1	1	0	0	1	1	0
409	1	52	1	0	0	1	1	0	0	1	1	0
410	2	52	0	1	0	1	1	0	0	1	1	0
411	3	52	1	1	0	1	1	0	0	1	1	0
412	4	52	0	0	1	1	1	0	0	1	1	0
413	5	52	1	0	1	1	1	0	0	1	1	0
414	6	52	0	1	1	1	1	0	0	1	1	0
415	7	52	1	1	1	1	1	0	0	1	1	0
416	8	52	0	0	0	0	0	1	0	1	1	0
417	1	53	1	0	0	0	0	1	0	1	1	0
418	2	53	0	1	0	0	0	1	0	1	1	0
419	3	53	1	1	0	0	0	1	0	1	1	0
420	4	53	0	0	1	0	0	1	0	1	1	0
421	5	53	1	0	1	0	0	1	0	1	1	0
422	6	53	0	1	1	0	0	1	0	1	1	0
423	7	53	1	1	1	0	0	1	0	1	1	0
424	8	53	0	0	0	1	0	1	0	1	1	0
425	1	54	1	0	0	1	0	1	0	1	1	0
426	2	54	0	1	0	1	0	1	0	1	1	0
427	3	54	1	1	0	1	0	1	0	1	1	0
428	4	54	0	0	1	1	0	1	0	1	1	0
429	5	54	1	0	1	1	0	1	0	1	1	0
430	6	54	0	1	1	1	0	1	0	1	1	0
431	7	54	1	1	1	1	0	1	0	1	1	0

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
432	8	54	0	0	0	0	1	1	0	1	1	0
433	1	55	1	0	0	0	1	1	0	1	1	0
434	2	55	0	1	0	0	1	1	0	1	1	0
435	3	55	1	1	0	0	1	1	0	1	1	0
436	4	55	0	0	1	0	1	1	0	1	1	0
437	5	55	1	0	1	0	1	1	0	1	1	0
438	6	55	0	1	1	0	1	1	0	1	1	0
439	7	55	1	1	1	0	1	1	0	1	1	0
440	8	55	0	0	0	1	1	1	0	1	1	0
441	1	56	1	0	0	1	1	1	0	1	1	0
442	2	56	0	1	0	1	1	1	0	1	1	0
443	3	56	1	1	0	1	1	1	0	1	1	0
444	4	56	0	0	1	1	1	1	0	1	1	0
445	5	56	1	0	1	1	1	1	0	1	1	0
446	6	56	0	1	1	1	1	1	0	1	1	0
447	7	56	1	1	1	1	1	1	0	1	1	0
448	8	56	0	0	0	0	0	0	1	1	1	0
449	1	57	1	0	0	0	0	0	1	1	1	0
450	2	57	0	1	0	0	0	0	1	1	1	0
451	3	57	1	1	0	0	0	0	1	1	1	0
452	4	57	0	0	1	0	0	0	1	1	1	0
453	5	57	1	0	1	0	0	0	1	1	1	0
454	6	57	0	1	1	0	0	0	1	1	1	0
455	7	57	1	1	1	0	0	0	1	1	1	0
456	8	57	0	0	0	1	0	0	1	1	1	0
457	1	58	1	0	0	1	0	0	1	1	1	0
458	2	58	0	1	0	1	0	0	1	1	1	0
459	3	58	1	1	0	1	0	0	1	1	1	0
460	4	58	0	0	1	1	0	0	1	1	1	0
461	5	58	1	0	1	1	0	0	1	1	1	0

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
462	6	58	0	1	1	1	0	0	1	1	1	0
463	7	58	1	1	1	1	0	0	1	1	1	0
464	8	58	0	0	0	0	1	0	1	1	1	0
465	1	59	1	0	0	0	1	0	1	1	1	0
466	2	59	0	1	0	0	1	0	1	1	1	0
467	3	59	1	1	0	0	1	0	1	1	1	0
468	4	59	0	0	1	0	1	0	1	1	1	0
469	5	59	1	0	1	0	1	0	1	1	1	0
470	6	59	0	1	1	0	1	0	1	1	1	0
471	7	59	1	1	1	0	1	0	1	1	1	0
472	8	59	0	0	0	1	1	0	1	1	1	0
473	1	60	1	0	0	1	1	0	1	1	1	0
474	2	60	0	1	0	1	1	0	1	1	1	0
475	3	60	1	1	0	1	1	0	1	1	1	0
476	4	60	0	0	1	1	1	0	1	1	1	0
477	5	60	1	0	1	1	1	0	1	1	1	0
478	6	60	0	1	1	1	1	0	1	1	1	0
479	7	60	1	1	1	1	1	0	1	1	1	0
480	8	60	0	0	0	0	0	1	1	1	1	0
481	1	61	1	0	0	0	0	1	1	1	1	0
482	2	61	0	1	0	0	0	1	1	1	1	0
483	3	61	1	1	0	0	0	1	1	1	1	0
484	4	61	0	0	1	0	0	1	1	1	1	0
485	5	61	1	0	1	0	0	1	1	1	1	0
486	6	61	0	1	1	0	0	1	1	1	1	0
487	7	61	1	1	1	0	0	1	1	1	1	0
488	8	61	0	0	0	1	0	1	1	1	1	0
489	1	62	1	0	0	1	0	1	1	1	1	0
490	2	62	0	1	0	1	0	1	1	1	1	0
491	3	62	1	1	0	1	0	1	1	1	1	0

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
492	4	62	0	0	1	1	0	1	1	1	1	0
493	5	62	1	0	1	1	0	1	1	1	1	0
494	6	62	0	1	1	1	0	1	1	1	1	0
495	7	62	1	1	1	1	0	1	1	1	1	0
496	8	62	0	0	0	0	1	1	1	1	1	0
497	1	63	1	0	0	0	1	1	1	1	1	0
498	2	63	0	1	0	0	1	1	1	1	1	0
499	3	63	1	1	0	0	1	1	1	1	1	0
500	4	63	0	0	1	0	1	1	1	1	1	0
501	5	63	1	0	1	0	1	1	1	1	1	0
502	6	63	0	1	1	0	1	1	1	1	1	0
503	7	63	1	1	1	0	1	1	1	1	1	0
504	8	63	0	0	0	1	1	1	1	1	1	0
505	1	64	1	0	0	1	1	1	1	1	1	0
506	2	64	0	1	0	1	1	1	1	1	1	0
507	3	64	1	1	0	1	1	1	1	1	1	0
508	4	64	0	0	1	1	1	1	1	1	1	0
509	5	64	1	0	1	1	1	1	1	1	1	0
510	6	64	0	1	1	1	1	1	1	1	1	0
511	7	64	1	1	1	1	1	1	1	1	1	0
512	8	64	0	0	0	0	0	0	0	0	0	1
513	1	65	1	0	0	0	0	0	0	0	0	1
514	2	65	0	1	0	0	0	0	0	0	0	1
515	3	65	1	1	0	0	0	0	0	0	0	1
516	4	65	0	0	1	0	0	0	0	0	0	1
517	5	65	1	0	1	0	0	0	0	0	0	1
518	6	65	0	1	1	0	0	0	0	0	0	1
519	7	65	1	1	1	0	0	0	0	0	0	1
520	8	65	0	0	0	1	0	0	0	0	0	1
521	1	66	1	0	0	1	0	0	0	0	0	1

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
522	2	66	0	1	0	1	0	0	0	0	0	1
523	3	66	1	1	0	1	0	0	0	0	0	1
524	4	66	0	0	1	1	0	0	0	0	0	1
525	5	66	1	0	1	1	0	0	0	0	0	1
526	6	66	0	1	1	1	0	0	0	0	0	1
527	7	66	1	1	1	1	0	0	0	0	0	1
528	8	66	0	0	0	0	1	0	0	0	0	1
529	1	67	1	0	0	0	1	0	0	0	0	1
530	2	67	0	1	0	0	1	0	0	0	0	1
531	3	67	1	1	0	0	1	0	0	0	0	1
532	4	67	0	0	1	0	1	0	0	0	0	1
533	5	67	1	0	1	0	1	0	0	0	0	1
534	6	67	0	1	1	0	1	0	0	0	0	1
535	7	67	1	1	1	0	1	0	0	0	0	1
536	8	67	0	0	0	1	1	0	0	0	0	1
537	1	68	1	0	0	1	1	0	0	0	0	1
538	2	68	0	1	0	1	1	0	0	0	0	1
539	3	68	1	1	0	1	1	0	0	0	0	1
540	4	68	0	0	1	1	1	0	0	0	0	1
541	5	68	1	0	1	1	1	0	0	0	0	1
542	6	68	0	1	1	1	1	0	0	0	0	1
543	7	68	1	1	1	1	1	0	0	0	0	1
544	8	68	0	0	0	0	0	1	0	0	0	1
545	1	69	1	0	0	0	0	1	0	0	0	1
546	2	69	0	1	0	0	0	1	0	0	0	1
547	3	69	1	1	0	0	0	1	0	0	0	1
548	4	69	0	0	1	0	0	1	0	0	0	1
549	5	69	1	0	1	0	0	1	0	0	0	1
550	6	69	0	1	1	0	0	1	0	0	0	1
551	7	69	1	1	1	0	0	1	0	0	0	1

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
552	8	69	0	0	0	1	0	1	0	0	0	1
553	1	70	1	0	0	1	0	1	0	0	0	1
554	2	70	0	1	0	1	0	1	0	0	0	1
555	3	70	1	1	0	1	0	1	0	0	0	1
556	4	70	0	0	1	1	0	1	0	0	0	1
557	5	70	1	0	1	1	0	1	0	0	0	1
558	6	70	0	1	1	1	0	1	0	0	0	1
559	7	70	1	1	1	1	0	1	0	0	0	1
560	8	70	0	0	0	0	1	1	0	0	0	1
561	1	71	1	0	0	0	1	1	0	0	0	1
562	2	71	0	1	0	0	1	1	0	0	0	1
563	3	71	1	1	0	0	1	1	0	0	0	1
564	4	71	0	0	1	0	1	1	0	0	0	1
565	5	71	1	0	1	0	1	1	0	0	0	1
566	6	71	0	1	1	0	1	1	0	0	0	1
567	7	71	1	1	1	0	1	1	0	0	0	1
568	8	71	0	0	0	1	1	1	0	0	0	1
569	1	72	1	0	0	1	1	1	0	0	0	1
570	2	72	0	1	0	1	1	1	0	0	0	1
571	3	72	1	1	0	1	1	1	0	0	0	1
572	4	72	0	0	1	1	1	1	0	0	0	1
573	5	72	1	0	1	1	1	1	0	0	0	1
574	6	72	0	1	1	1	1	1	0	0	0	1
575	7	72	1	1	1	1	1	1	0	0	0	1
576	8	72	0	0	0	0	0	0	1	0	0	1
577	1	73	1	0	0	0	0	0	1	0	0	1
578	2	73	0	1	0	0	0	0	1	0	0	1
579	3	73	1	1	0	0	0	0	1	0	0	1
580	4	73	0	0	1	0	0	0	1	0	0	1
581	5	73	1	0	1	0	0	0	1	0	0	1

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
582	6	73	0	1	1	0	0	0	1	0	0	1
583	7	73	1	1	1	0	0	0	1	0	0	1
584	8	73	0	0	0	1	0	0	1	0	0	1
585	1	74	1	0	0	1	0	0	1	0	0	1
586	2	74	0	1	0	1	0	0	1	0	0	1
587	3	74	1	1	0	1	0	0	1	0	0	1
588	4	74	0	0	1	1	0	0	1	0	0	1
589	5	74	1	0	1	1	0	0	1	0	0	1
590	6	74	0	1	1	1	0	0	1	0	0	1
591	7	74	1	1	1	1	0	0	1	0	0	1
592	8	74	0	0	0	0	1	0	1	0	0	1
593	1	75	1	0	0	0	1	0	1	0	0	1
594	2	75	0	1	0	0	1	0	1	0	0	1
595	3	75	1	1	0	0	1	0	1	0	0	1
596	4	75	0	0	1	0	1	0	1	0	0	1
597	5	75	1	0	1	0	1	0	1	0	0	1
598	6	75	0	1	1	0	1	0	1	0	0	1
599	7	75	1	1	1	0	1	0	1	0	0	1
600	8	75	0	0	0	1	1	0	1	0	0	1
601	1	76	1	0	0	1	1	0	1	0	0	1
602	2	76	0	1	0	1	1	0	1	0	0	1
603	3	76	1	1	0	1	1	0	1	0	0	1
604	4	76	0	0	1	1	1	0	1	0	0	1
605	5	76	1	0	1	1	1	0	1	0	0	1
606	6	76	0	1	1	1	1	0	1	0	0	1
607	7	76	1	1	1	1	1	0	1	0	0	1
608	8	76	0	0	0	0	0	1	1	0	0	1
609	1	77	1	0	0	0	0	1	1	0	0	1
610	2	77	0	1	0	0	0	1	1	0	0	1
611	3	77	1	1	0	0	0	1	1	0	0	1

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
612	4	77	0	0	1	0	0	1	1	0	0	1
613	5	77	1	0	1	0	0	1	1	0	0	1
614	6	77	0	1	1	0	0	1	1	0	0	1
615	7	77	1	1	1	0	0	1	1	0	0	1
616	8	77	0	0	0	1	0	1	1	0	0	1
617	1	78	1	0	0	1	0	1	1	0	0	1
618	2	78	0	1	0	1	0	1	1	0	0	1
619	3	78	1	1	0	1	0	1	1	0	0	1
620	4	78	0	0	1	1	0	1	1	0	0	1
621	5	78	1	0	1	1	0	1	1	0	0	1
622	6	78	0	1	1	1	0	1	1	0	0	1
623	7	78	1	1	1	1	0	1	1	0	0	1
624	8	78	0	0	0	0	1	1	1	0	0	1
625	1	79	1	0	0	0	1	1	1	0	0	1
626	2	79	0	1	0	0	1	1	1	0	0	1
627	3	79	1	1	0	0	1	1	1	0	0	1
628	4	79	0	0	1	0	1	1	1	0	0	1
629	5	79	1	0	1	0	1	1	1	0	0	1
630	6	79	0	1	1	0	1	1	1	0	0	1
631	7	79	1	1	1	0	1	1	1	0	0	1
632	8	79	0	0	0	1	1	1	1	0	0	1
633	1	80	1	0	0	1	1	1	1	0	0	1
634	2	80	0	1	0	1	1	1	1	0	0	1
635	3	80	1	1	0	1	1	1	1	0	0	1
636	4	80	0	0	1	1	1	1	1	0	0	1
637	5	80	1	0	1	1	1	1	1	0	0	1
638	6	80	0	1	1	1	1	1	1	0	0	1
639	7	80	1	1	1	1	1	1	1	0	0	1
640	8	80	0	0	0	0	0	0	0	1	0	1
641	1	81	1	0	0	0	0	0	0	1	0	1

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
642	2	81	0	1	0	0	0	0	0	1	0	1
643	3	81	1	1	0	0	0	0	0	1	0	1
644	4	81	0	0	1	0	0	0	0	1	0	1
645	5	81	1	0	1	0	0	0	0	1	0	1
646	6	81	0	1	1	0	0	0	0	1	0	1
647	7	81	1	1	1	0	0	0	0	1	0	1
648	8	81	0	0	0	1	0	0	0	1	0	1
649	1	82	1	0	0	1	0	0	0	1	0	1
650	2	82	0	1	0	1	0	0	0	1	0	1
651	3	82	1	1	0	1	0	0	0	1	0	1
652	4	82	0	0	1	1	0	0	0	1	0	1
653	5	82	1	0	1	1	0	0	0	1	0	1
654	6	82	0	1	1	1	0	0	0	1	0	1
655	7	82	1	1	1	1	0	0	0	1	0	1
656	8	82	0	0	0	0	1	0	0	1	0	1
657	1	83	1	0	0	0	1	0	0	1	0	1
658	2	83	0	1	0	0	1	0	0	1	0	1
659	3	83	1	1	0	0	1	0	0	1	0	1
660	4	83	0	0	1	0	1	0	0	1	0	1
661	5	83	1	0	1	0	1	0	0	1	0	1
662	6	83	0	1	1	0	1	0	0	1	0	1
663	7	83	1	1	1	0	1	0	0	1	0	1
664	8	83	0	0	0	1	1	0	0	1	0	1
665	1	84	1	0	0	1	1	0	0	1	0	1
666	2	84	0	1	0	1	1	0	0	1	0	1
667	3	84	1	1	0	1	1	0	0	1	0	1
668	4	84	0	0	1	1	1	0	0	1	0	1
669	5	84	1	0	1	1	1	0	0	1	0	1
670	6	84	0	1	1	1	1	0	0	1	0	1
671	7	84	1	1	1	1	1	0	0	1	0	1

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
672	8	84	0	0	0	0	0	1	0	1	0	1
673	1	85	1	0	0	0	0	1	0	1	0	1
674	2	85	0	1	0	0	0	1	0	1	0	1
675	2	85	1	1	0	0	0	1	0	1	0	1
676	4	85	0	0	1	0	0	1	0	1	0	1
677	5	85	1	0	1	0	0	1	0	1	0	1
678	6	85	0	1	1	0	0	1	0	1	0	1
679	7	85	1	1	1	0	0	1	0	1	0	1
680	8	85	0	0	0	1	0	1	0	1	0	1
681	1	86	1	0	0	1	0	1	0	1	0	1
682	2	86	0	1	0	1	0	1	0	1	0	1
683	3	86	1	1	0	1	0	1	0	1	0	1
684	4	86	0	0	1	1	0	1	0	1	0	1
685	5	86	1	0	1	1	0	1	0	1	0	1
686	6	86	0	1	1	1	0	1	0	1	0	1
687	7	86	1	1	1	1	0	1	0	1	0	1
688	8	86	0	0	0	0	1	1	0	1	0	1
689	1	87	1	0	0	0	1	1	0	1	0	1
690	2	87	0	1	0	0	1	1	0	1	0	1
691	3	87	1	1	0	0	1	1	0	1	0	1
692	4	87	0	0	1	0	1	1	0	1	0	1
693	5	87	1	0	1	0	1	1	0	1	0	1
694	6	87	0	1	1	0	1	1	0	1	0	1
695	7	87	1	1	1	0	1	1	0	1	0	1
696	8	87	0	0	0	1	1	1	0	1	0	1
697	1	88	1	0	0	1	1	1	0	1	0	1
698	2	88	0	1	0	1	1	1	0	1	0	1
699	3	88	1	1	0	1	1	1	0	1	0	1
700	4	88	0	0	1	1	1	1	0	1	0	1
701	5	88	1	0	1	1	1	1	0	1	0	1

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
702	6	88	0	1	1	1	1	1	0	1	0	1
703	7	88	1	1	1	1	1	1	0	1	0	1
704	8	88	0	0	0	0	0	0	1	1	0	1
705	1	89	1	0	0	0	0	0	1	1	0	1
706	2	89	0	1	0	0	0	0	1	1	0	1
707	3	89	1	1	0	0	0	0	1	1	0	1
708	4	89	0	0	1	0	0	0	1	1	0	1
709	5	89	1	0	1	0	0	0	1	1	0	1
710	6	89	0	1	1	0	0	0	1	1	0	1
711	7	89	1	1	1	0	0	0	1	1	0	1
712	8	89	0	0	0	1	0	0	1	1	0	1
713	1	90	1	0	0	1	0	0	1	1	0	1
714	2	90	0	1	0	1	0	0	1	1	0	1
715	3	90	1	1	0	1	0	0	1	1	0	1
716	4	90	0	0	1	1	0	0	1	1	0	1
717	5	90	1	0	1	1	0	0	1	1	0	1
718	6	90	0	1	1	1	0	0	1	1	0	1
719	7	90	1	1	1	1	0	0	1	1	0	1
720	8	90	0	0	0	0	1	0	1	1	0	1
721	1	91	1	0	0	0	1	0	1	1	0	1
722	2	91	0	1	0	0	1	0	1	1	0	1
723	3	91	1	1	0	0	1	0	1	1	0	1
724	4	91	0	0	1	0	1	0	1	1	0	1
725	5	91	1	0	1	0	1	0	1	1	0	1
726	6	91	0	1	1	0	1	0	1	1	0	1
727	7	91	1	1	1	0	1	0	1	1	0	1
728	8	91	0	0	0	1	1	0	1	1	0	1
729	1	92	1	0	0	1	1	0	1	1	0	1
730	2	92	0	1	0	1	1	0	1	1	0	1
731	3	92	1	1	0	1	1	0	1	1	0	1

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
732	4	92	0	0	1	1	1	0	1	1	0	1
733	5	92	1	0	1	1	1	0	1	1	0	1
734	6	92	0	1	1	1	1	0	1	1	0	1
735	7	92	1	1	1	1	1	0	1	1	0	1
736	8	92	0	0	0	0	0	1	1	1	0	1
737	1	93	1	0	0	0	0	1	1	1	0	1
738	2	93	0	1	0	0	0	1	1	1	0	1
739	3	93	1	1	0	0	0	1	1	1	0	1
740	4	93	0	0	1	0	0	1	1	1	0	1
741	5	93	1	0	1	0	0	1	1	1	0	1
742	6	93	0	1	1	0	0	1	1	1	0	1
743	7	93	1	1	1	0	0	1	1	1	0	1
744	8	93	0	0	0	1	0	1	1	1	0	1
745	1	94	1	0	0	1	0	1	1	1	0	1
746	2	94	0	1	0	1	0	1	1	1	0	1
747	3	94	1	1	0	1	0	1	1	1	0	1
748	4	94	0	0	1	1	0	1	1	1	0	1
749	5	94	1	0	1	1	0	1	1	1	0	1
750	6	94	0	1	1	1	0	1	1	1	0	1
751	7	94	1	1	1	1	0	1	1	1	0	1
752	8	94	0	0	0	0	1	1	1	1	0	1
753	1	95	1	0	0	0	1	1	1	1	0	1
754	2	95	0	1	0	0	1	1	1	1	0	1
755	3	95	1	1	0	0	1	1	1	1	0	1
756	4	95	0	0	1	0	1	1	1	1	0	1
757	5	95	1	0	1	0	1	1	1	1	0	1
758	6	95	0	1	1	0	1	1	1	1	0	1
759	7	95	1	1	1	0	1	1	1	1	0	1
760	8	95	0	0	0	1	1	1	1	1	0	1
761	1	96	1	0	0	1	1	1	1	1	0	1

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
762	2	96	0	1	0	1	1	1	1	1	0	1
763	3	96	1	1	0	1	1	1	1	1	0	1
764	4	96	0	0	1	1	1	1	1	1	0	1
765	5	96	1	0	1	1	1	1	1	1	0	1
766	6	96	0	1	1	1	1	1	1	1	0	1
767	7	96	1	1	1	1	1	1	1	1	0	1
768	8	96	0	0	0	0	0	0	0	0	1	1
769	1	97	1	0	0	0	0	0	0	0	1	1
770	2	97	0	1	0	0	0	0	0	0	1	1
771	3	97	1	1	0	0	0	0	0	0	1	1
772	4	97	0	0	1	0	0	0	0	0	1	1
773	5	97	1	0	1	0	0	0	0	0	1	1
774	6	97	0	1	1	0	0	0	0	0	1	1
775	7	97	1	1	1	0	0	0	0	0	1	1
776	8	97	0	0	0	1	0	0	0	0	1	1
777	1	98	1	0	0	1	0	0	0	0	1	1
778	2	98	0	1	0	1	0	0	0	0	1	1
779	3	98	1	1	0	1	0	0	0	0	1	1
780	4	98	0	0	1	1	0	0	0	0	1	1
781	5	98	1	0	1	1	0	0	0	0	1	1
782	6	98	0	1	1	1	0	0	0	0	1	1
783	7	98	1	1	1	1	0	0	0	0	1	1
784	8	98	0	0	0	0	1	0	0	0	1	1
785	1	99	1	0	0	0	1	0	0	0	1	1
786	2	99	0	1	0	0	1	0	0	0	1	1
787	3	99	1	1	0	0	1	0	0	0	1	1
788	4	99	0	0	1	0	1	0	0	0	1	1
789	5	99	1	0	1	0	1	0	0	0	1	1
790	6	99	0	1	1	0	1	0	0	0	1	1
791	7	99	1	1	1	0	1	0	0	0	1	1

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
792	8	99	0	0	0	1	1	0	0	0	1	1
793	1	100	1	0	0	1	1	0	0	0	1	1
794	2	100	0	1	0	1	1	0	0	0	1	1
795	3	100	1	1	0	1	1	0	0	0	1	1
796	4	100	0	0	1	1	1	0	0	0	1	1
797	5	100	1	0	1	1	1	0	0	0	1	1
798	6	100	0	1	1	1	1	0	0	0	1	1
799	7	100	1	1	1	1	1	0	0	0	1	1
800	8	100	0	0	0	0	0	1	0	0	1	1
801	1	101	1	0	0	0	0	0	1	0	0	1
802	2	101	0	1	0	0	0	1	0	0	1	1
803	3	101	1	1	0	0	0	1	0	0	1	1
804	4	101	0	0	1	0	0	1	0	0	1	1
805	5	101	1	0	1	0	0	1	0	0	1	1
806	6	101	0	1	1	0	0	1	0	0	1	1
807	7	101	1	1	1	0	0	1	0	0	1	1
808	8	101	0	0	0	1	0	1	0	0	1	1
809	1	102	1	0	0	1	0	1	0	0	1	1
810	2	102	0	1	0	1	0	1	0	0	1	1
811	3	102	1	1	0	1	0	1	0	0	1	1
812	4	102	0	0	1	1	0	1	0	0	1	1
813	5	102	1	0	1	1	0	1	0	0	1	1
814	6	102	0	1	1	1	0	1	0	0	1	1
815	7	102	1	1	1	1	0	1	0	0	1	1
816	8	102	0	0	0	0	1	1	0	0	1	1
817	1	103	1	0	0	0	1	1	0	0	1	1
818	2	103	0	1	0	0	1	1	0	0	1	1
819	3	103	1	1	0	0	1	1	0	0	1	1
820	4	103	0	0	1	0	1	1	0	0	1	1
821	5	103	1	0	1	0	0	1	1	0	0	1

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
822	6	103	0	1	1	0	1	1	0	0	1	1
823	7	103	1	1	1	0	1	1	0	0	1	1
824	8	103	0	0	0	1	1	1	0	0	1	1
825	1	104	1	0	0	1	1	1	0	0	1	1
826	2	104	0	1	0	1	1	1	0	0	1	1
827	3	104	1	1	0	1	1	1	0	0	1	1
828	4	104	0	0	1	1	1	1	0	0	1	1
829	5	104	1	0	1	1	1	1	0	0	1	1
830	6	104	0	1	1	1	1	1	0	0	1	1
831	7	104	1	1	1	1	1	1	0	0	1	1
832	8	104	0	0	0	0	0	0	1	0	1	1
833	1	105	1	0	0	0	0	0	1	0	1	1
834	2	105	0	1	0	0	0	0	1	0	1	1
835	3	105	1	1	0	0	0	0	1	0	1	1
836	4	105	0	0	1	0	0	0	1	0	1	1
837	5	105	1	0	1	0	0	0	1	0	1	1
838	6	105	0	1	1	0	0	0	1	0	1	1
839	7	105	1	1	1	0	0	0	1	0	1	1
840	8	105	0	0	0	1	0	0	1	0	1	1
841	1	106	1	0	0	1	0	0	1	0	1	1
842	2	106	0	1	0	1	0	0	1	0	1	1
843	3	106	1	1	0	1	0	0	1	0	1	1
844	4	106	0	0	1	1	0	0	1	0	1	1
845	5	106	1	0	1	1	0	0	1	0	1	1
846	6	106	0	1	1	1	0	0	1	0	1	1
847	7	106	1	1	1	1	0	0	1	0	1	1
848	8	106	0	0	0	0	1	0	1	0	1	1
849	1	107	1	0	0	0	1	0	1	0	1	1
850	2	107	0	1	0	0	1	0	1	0	1	1
851	3	107	1	1	0	0	1	0	1	0	1	1

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
852	4	107	0	0	1	0	1	0	1	0	1	1
853	5	107	1	0	1	0	1	0	1	0	1	1
854	6	107	0	1	1	0	1	0	1	0	1	1
855	7	107	1	1	1	0	1	0	1	0	1	1
856	8	107	0	0	0	1	1	0	1	0	1	1
857	1	108	1	0	0	1	1	0	1	0	1	1
858	2	108	0	1	0	1	1	0	1	0	1	1
859	3	108	1	1	0	1	1	0	1	0	1	1
860	4	108	0	0	1	1	1	0	1	0	1	1
861	5	108	1	0	1	1	1	0	1	0	1	1
862	6	108	0	1	1	1	1	0	1	0	1	1
863	7	108	1	1	1	1	1	0	1	0	1	1
864	8	108	0	0	0	0	0	1	1	0	1	1
865	1	109	1	0	0	0	0	1	1	0	1	1
866	2	109	0	1	0	0	0	1	1	0	1	1
867	3	109	1	1	0	0	0	1	1	0	1	1
868	4	109	0	0	1	0	0	1	1	0	1	1
869	5	109	1	0	1	0	0	1	1	0	1	1
870	6	109	0	1	1	0	0	1	1	0	1	1
871	7	109	1	1	1	0	0	1	1	0	1	1
872	8	109	0	0	0	1	0	1	1	0	1	1
873	1	110	1	0	0	1	0	1	1	0	1	1
874	2	110	0	1	0	1	0	1	1	0	1	1
875	3	110	1	1	0	1	0	1	1	0	1	1
876	4	110	0	0	1	1	0	1	1	0	1	1
877	5	110	1	0	1	1	0	1	1	0	1	1
878	6	110	0	1	1	1	0	1	1	0	1	1
879	7	110	1	1	1	1	0	1	1	0	1	1
880	8	110	0	0	0	0	1	1	1	0	1	1
881	1	111	1	0	0	0	1	1	1	0	1	1

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
882	2	111	0	1	0	0	1	1	1	0	1	1
883	3	111	1	1	0	0	1	1	1	0	1	1
884	4	111	0	0	1	0	1	1	1	0	1	1
885	5	111	1	0	1	0	1	1	1	0	1	1
886	6	111	0	1	1	0	1	1	1	0	1	1
887	7	111	1	1	1	0	1	1	1	0	1	1
888	8	111	0	0	0	1	1	1	1	0	1	1
889	1	112	1	0	0	1	1	1	1	0	1	1
890	2	112	0	1	0	1	1	1	1	0	1	1
891	3	112	1	1	0	1	1	1	1	0	1	1
892	4	112	0	0	1	1	1	1	1	0	1	1
893	5	112	1	0	1	1	1	1	1	0	1	1
894	6	112	0	1	1	1	1	1	1	0	1	1
895	7	112	1	1	1	1	1	1	1	0	1	1
896	8	112	0	0	0	0	0	0	0	1	1	1
897	1	113	1	0	0	0	0	0	0	0	1	1
898	2	113	0	1	0	0	0	0	0	0	1	1
899	3	113	1	1	0	0	0	0	0	0	1	1
900	4	113	0	0	1	0	0	0	0	0	1	1
901	5	113	1	0	1	0	0	0	0	1	1	1
902	6	113	0	1	1	0	0	0	0	1	1	1
903	7	113	1	1	1	0	0	0	0	1	1	1
904	8	113	0	0	0	1	0	0	0	1	1	1
905	1	114	1	0	0	1	0	0	0	1	1	1
906	2	114	0	1	0	1	0	0	0	1	1	1
907	3	114	1	1	0	1	0	0	0	1	1	1
908	4	114	0	0	1	1	0	0	0	1	1	1
909	5	114	1	0	1	1	0	0	0	1	1	1
910	6	114	0	1	1	1	0	0	0	1	1	1
911	7	114	1	1	1	1	0	0	0	1	1	1

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
912	8	114	0	0	0	0	1	0	0	1	1	1
913	1	115	1	0	0	0	1	0	0	1	1	1
914	2	115	0	1	0	0	1	0	0	1	1	1
915	3	115	1	1	0	0	1	0	0	1	1	1
916	4	115	0	0	1	0	1	0	0	1	1	1
917	5	115	1	0	1	0	1	0	0	1	1	1
918	6	115	0	1	1	0	1	0	0	1	1	1
919	7	115	1	1	1	0	1	0	0	1	1	1
920	8	115	0	0	0	1	1	0	0	1	1	1
921	1	116	1	0	0	1	1	0	0	1	1	1
922	2	116	0	1	0	1	1	0	0	1	1	1
923	3	116	1	1	0	1	1	0	0	1	1	1
924	4	116	0	0	1	1	1	0	0	1	1	1
925	5	116	1	0	1	1	1	0	0	1	1	1
926	6	116	0	1	1	1	1	0	0	1	1	1
927	7	116	1	1	1	1	1	0	0	1	1	1
928	8	116	0	0	0	0	0	1	0	1	1	1
929	1	117	1	0	0	0	0	1	0	1	1	1
930	2	117	0	1	0	0	0	1	0	1	1	1
931	3	117	1	1	0	0	0	1	0	1	1	1
932	4	117	0	0	1	0	0	1	0	1	1	1
933	5	117	1	0	1	0	0	1	0	1	1	1
934	6	117	0	1	1	0	0	1	0	1	1	1
935	7	117	1	1	1	0	0	1	0	1	1	1
936	8	117	0	0	0	1	0	1	0	1	1	1
937	1	118	1	0	0	1	0	1	0	1	1	1
938	2	118	0	1	0	1	0	1	0	1	1	1
939	3	118	1	1	0	1	0	1	0	1	1	1
940	4	118	0	0	1	1	0	1	0	1	1	1
941	5	118	1	0	1	1	0	1	0	1	1	1

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*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
942	6	118	0	1	1	1	0	1	0	1	1	1
943	7	118	1	1	1	1	0	1	0	1	1	1
944	8	118	0	0	0	0	1	1	0	1	1	1
945	1	119	1	0	0	0	1	1	0	1	1	1
946	2	119	0	1	0	0	1	1	0	1	1	1
947	3	119	1	1	0	0	1	1	0	1	1	1
948	4	119	0	0	1	0	1	1	0	1	1	1
949	5	119	1	0	1	0	1	1	0	1	1	1
950	6	119	0	1	1	0	1	1	0	1	1	1
951	7	119	1	1	1	0	1	1	0	1	1	1
952	8	119	0	0	0	1	1	1	0	1	1	1
953	1	120	1	0	0	1	1	1	0	1	1	1
954	2	120	0	1	0	1	1	1	0	1	1	1
955	3	120	1	1	0	1	1	1	0	1	1	1
956	4	120	0	0	1	1	1	1	0	1	1	1
957	5	120	1	0	1	1	1	1	0	1	1	1
958	6	120	0	1	1	1	1	1	0	1	1	1
959	7	120	1	1	1	1	1	1	0	1	1	1
960	8	120	0	0	0	0	0	0	1	1	1	1
961	1	121	1	0	0	0	0	0	1	1	1	1
962	2	121	0	1	0	0	0	0	1	1	1	1
963	3	121	1	1	0	0	0	0	1	1	1	1
964	4	121	0	0	1	0	0	0	1	1	1	1
965	5	121	1	0	1	0	0	0	1	1	1	1
966	6	121	0	1	1	0	0	0	1	1	1	1
967	7	121	1	1	1	0	0	0	1	1	1	1
968	8	121	0	0	0	1	0	0	1	1	1	1
969	1	122	1	0	0	1	0	0	1	1	1	1
970	2	122	0	1	0	1	0	0	1	1	1	1
971	3	122	1	1	0	1	0	0	1	1	1	1

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
972	4	122	0	0	1	1	0	0	1	1	1	1
973	5	122	1	0	1	1	0	0	1	1	1	1
974	6	122	0	1	1	1	0	0	1	1	1	1
975	7	122	1	1	1	1	0	0	1	1	1	1
976	8	122	0	0	0	0	1	0	1	1	1	1
977	1	123	1	0	0	0	1	0	1	1	1	1
978	2	123	0	1	0	0	1	0	1	1	1	1
979	3	123	1	1	0	0	1	0	1	1	1	1
980	4	123	0	0	1	0	1	0	1	1	1	1
981	5	123	1	0	1	0	1	0	1	1	1	1
982	6	123	0	1	1	0	1	0	1	1	1	1
983	7	123	1	1	1	0	1	0	1	1	1	1
984	8	123	0	0	0	1	1	0	1	1	1	1
985	1	124	1	0	0	1	1	0	1	1	1	1
986	2	124	0	1	0	1	1	0	1	1	1	1
987	3	124	1	1	0	1	1	0	1	1	1	1
988	4	124	0	0	1	1	1	0	1	1	1	1
989	5	124	1	0	1	1	1	0	1	1	1	1
990	6	124	0	1	1	1	1	0	1	1	1	1
991	7	124	1	1	1	1	1	0	1	1	1	1
992	8	124	0	0	0	0	0	1	1	1	1	1
993	1	125	1	0	0	0	0	1	1	1	1	1
994	2	125	0	1	0	0	0	1	1	1	1	1
995	3	125	1	1	0	0	0	1	1	1	1	1
996	4	125	0	0	1	0	0	1	1	1	1	1
997	5	125	1	0	1	0	0	1	1	1	1	1
998	6	125	0	1	1	0	0	1	1	1	1	1
999	7	125	1	1	1	0	0	1	1	1	1	1
1000	8	125	0	0	0	1	0	1	1	1	1	1
1001	1	126	1	0	0	1	0	1	1	1	1	1

A

*Table A-1. Presets, Preset Levels, and Analog Input Channels*

Pre-set No.	Pre-set key	Pre-set level	Analog Controller Channel Number									
			1	2	3	4	5	6	7	8	9	10
1002	2	126	0	1	0	1	0	1	1	1	1	1
1003	3	126	1	1	0	1	0	1	1	1	1	1
1004	4	126	0	0	1	1	0	1	1	1	1	1
1005	5	126	1	0	1	1	0	1	1	1	1	1
1006	6	126	0	1	1	1	0	1	1	1	1	1
1007	7	126	1	1	1	1	0	1	1	1	1	1
1008	8	126	0	0	0	0	1	1	1	1	1	1
1009	1	127	1	0	0	0	1	1	1	1	1	1
1010	2	127	0	1	0	0	1	1	1	1	1	1
1011	3	127	1	1	0	0	1	1	1	1	1	1
1012	4	127	0	0	1	0	1	1	1	1	1	1
1013	5	127	1	0	1	0	1	1	1	1	1	1
1014	6	127	0	1	1	0	1	1	1	1	1	1
1015	7	127	1	1	1	0	1	1	1	1	1	1
1016	8	127	0	0	0	1	1	1	1	1	1	1
1017	1	128	1	0	0	1	1	1	1	1	1	1
1018	2	128	0	1	0	1	1	1	1	1	1	1
1019	3	128	1	1	0	1	1	1	1	1	1	1
1020	4	128	0	0	1	1	1	1	1	1	1	1
1021	5	128	1	0	1	1	1	1	1	1	1	1
1022	6	128	0	1	1	1	1	1	1	1	1	1
1023	7	128	1	1	1	1	1	1	1	1	1	1

# **Appendix B**

## **Construct Parameters**

Table B-1 below lists the available constructs for the Studio Color LCD controller, their parameter values and defaults.

*Table B-1. Construct Parameters and Values*

<b>Construct</b>	<b>Value Range</b>	<b>Default</b>
Gate	Open, Closed, Strobe speed 0 (slowest) thru 59 (fastest) Random strobe 0 (slowest) thru 59 (fastest)	Closed
Red/Green/ Blue	0—255 (0%—FF%)	255
Lens 1 (wide)	0 (open)  1—100 (39%): wide angle  101 (39%)—220 (86%): beam shaping  221 (86%)—255 (FF%): less beam shaping to open	0
Flip	n/a	n/a
MSpeed	1—99	99
XFade	0.1—99.0	0.1
Dim	0-99	99

*Table B-1. Construct Parameters and Values*

Construct	Value Range	Default
Color	1—6 (color wheel position)  forward spin speed 1 (slowest) thru 16 (fastest)  cycle speed 1 (slowest) thru 16 (fastest)  reverse spin speed 1 (slowest) thru 16 (fastest)  random speed 1 (slowest) thru 16 (fastest)  continuous	1 (open)
Lens 2 (frost)	0 (open)  1—100 (39%): frost  101 (39%)—220 (86%): beam shaping  221 (86%)—255 (FF%): less beam shaping to open	0
Mode	normal color mixing double color mixing	normal
Position	Joystick Preset 1—99	Joystick
Delay	0.0—99.0 Hold for manual advance	0.0

Table B-2 below lists the values for the Color construct and how those values are displayed when you “view” a fixture as described in the section titled “Viewing Fixtures” on page 4-25.

*Table B-2. Color Construct Values*

Construct Value	Address View Display
1 (position on fixed color wheel) through 6 (position on fixed color wheel)	1 through 6
Forward spin speed 1 through Forward spin speed 16	-> 1 through -> 16
Cycle speed 1 through Cycle speed 16	@ 1 through @ 16
Reverse spin speed 1 through Reverse spin speed 16	<- 1 through <- 16
Random speed 1 through Random speed 16	* 1 through *16
Continuous color 1	0
Continuous color 1/2	5
Continuous color 2	10
Continuous color 2/3	15
Continuous color 3	20
Continuous color 3/4	25
Continuous color 4	30
Continuous color 4/5	35
Continuous color 5	40

*Table B-2. Color Construct Values*

Construct Value	Address View Display
Continuous color 5/6	45
Continuous color 6	50
Continuous color 6/1	55

**Note** Other values are possible for continuous color combinations “between” those listed above. For example, if you select the following value for continuous color (“between” 1/2 and 2) the display will read **C7**.

```
gate dim COLOR cspeed cmode position sp->
COLOR: continuous [...1/2...2...] P:x
```

# **Appendix C**

## **Pinouts and Wiring Diagrams**

This Appendix lists connector pinouts and shows how to wire various types of cabling you can use to back up and restore controller memory to a personal computer, or to crossload memory between controllers.

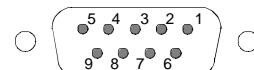
This Appendix should be used by highly-technical individuals who are already familiar with how to wire cabling. Other users should consult the instructions in Chapter 7.

### **DTE and DCE Equipment**

---

The RS-232CC port on the rear panel of the LCD controller is *DCE* (Data Circuit-Terminating Equipment), while all other connectors shown in the rest of this Appendix are *DTE* (Data Terminal Equipment).

The pinout of the RS-232C port on the LCD controller is shown in Figure C-1:



Pin #	Definition
1	not used
2	TxD (transmit data)
3	RxD (receive data)
4	Data Terminal Ready (+5V)
5	GND (signal ground)
6	not used
7	not used
8	not used
9	not used

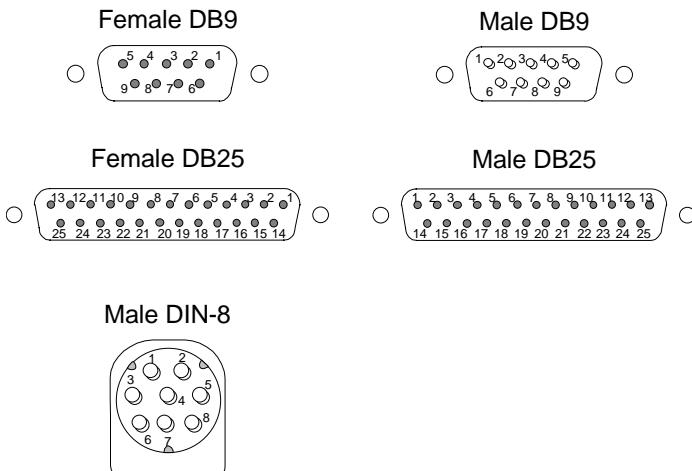
C

*Figure C-1. Pinout of the LCD controller's RS-232C communication port.*

# **Connector Pin Numbering**

---

Figure C-2 shows how pins are numbered on DTE connectors:

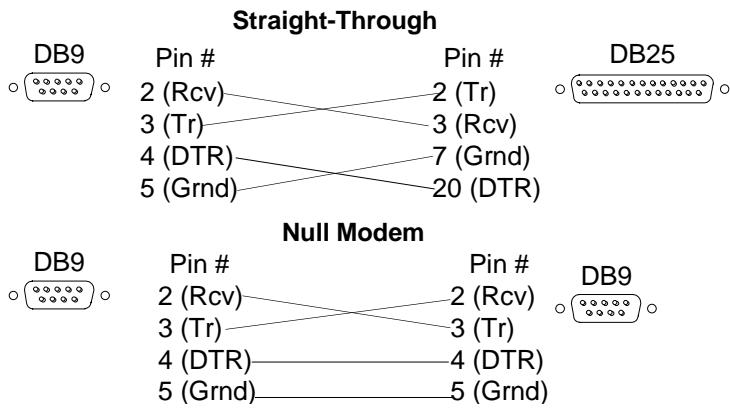


*Figure C-2. Pin numbering system used for wiring cabling.*

The male DIN-8 connector is for a Macintosh cable. The other connectors could be used on either cabling or adapters (for example, a DB9-to-DB25 adapter).

## ***IBM-Compatible Wiring Diagrams***

Figure C-3 shows wiring diagrams for IBM-compatible systems:



*Figure C-3. Wiring cables for backing up or restoring controller memory using an IBM-compatible machine.*

**Note** Male connectors are shown for simplicity.

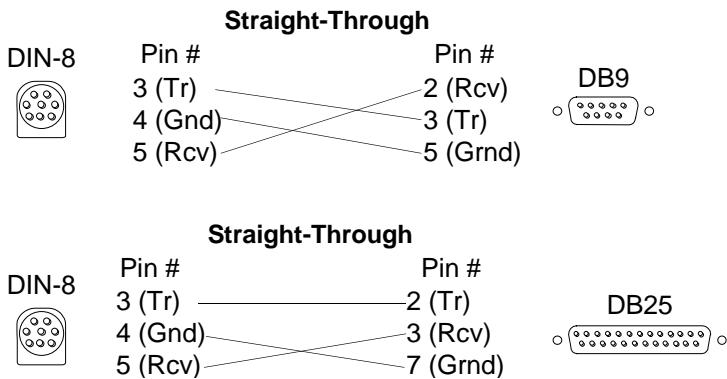
The top diagram could be used to wire either a straight-through cable or a DB9-to-DB25 adapter.

The null modem wiring diagram could be used *only* to crossload between two controllers as described in the section titled “Crossloading” on page 7-30.

# **Macintosh Wiring Diagrams**

---

Figure C-4 shows wiring diagrams for Macintosh systems:



*Figure C-4. Wiring cables for backing up or restoring controller memory using a Macintosh.*

**Note** Male connectors are shown for simplicity.

# **Appendix D**

## **Important Safety Information**

### **WARNING: For Continued Protection Against Fire**

1. This equipment is designed for connection to a branch circuit having a maximum overload protection of 20 A.
2. Replace fuses with the specified type and rating *ONLY*.

### **WARNING: For Continued Protection Against Electric Shock**

1. Refer servicing to qualified service personnel. No user serviceable parts inside.
2. Do not expose to rain or moisture.
3. If this equipment was received without a line cord plug, attach the appropriate line cord plug according to the following code:
  - Brown—Live
  - Blue—Neutral
  - Green/Yellow—Earth
4. As the colours of the cores in the mains lead of this equipment may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:
  - - the core which is coloured green and yellow must be connected to the terminal in the plug which is marked with the letter E or by the earth symbol  , or coloured green or green and yellow.
  - - the core which is coloured blue must be connected to the terminal which is marked with the letter N or coloured black.
  - - the core which is coloured brown must be connected to the terminal which is marked with the letter L or coloured red.
5. **THIS EQUIPMENT MUST BE EARTHED.**

D

# **Appendice D**

## **Important: Informations De Sécurité**

### **MISE EN GARDE: Pour Une Protection Permanente Contre Les Incendies**

1. Cet équipement est conçu pour connexion à un circuit de dérivation ayant une protection de surcharge maximum de 20 A.
2. Remplacez les fusibles UNIQUEMENT par le type et la puissance précisés.

### **MISE EN GARDE: Pour Une Protection Permanente Contre Les Chocs Électriques**

1. L'utilisateur ne peut pas accéder aux pièces à l'intérieur de cet appareil. Seul du personnel qualifié est habilité à réparer cet appareil.
2. Ne pas exposer l'appareil à la pluie ou l'humidité.
3. Si l'appareil n'a pas été livré avec une prise de cordon électrique, attacher la prise de corde électrique conformément au code suivant:
  - BRUN- BRANCHE
  - BLEU- NEUTRE
  - VERT/JAUNE - TERRE
4. **L'EQUIPEMENT DOIT ETRE MIS A LA TERRE.**

# **Anhang D**

## **Wichtige**

## **Sicherheitshinweise**

### **WARNUNG: Zum Schutz vor Brandgefahr**

1. Dieses Gerät ist für den Anschluß an ein Stromnetz mit einem Überlastungsschutz von höchstens 20 A bestimmt.
2. Ersatzsicherungen müssen den angegebenen Spezifikationen und Kennwerten entsprechen.

### **WARNUNG: Zum Schutz gegen gefährliche Körperströme**

1. Das Gerät enthält keine wartungsfähigen Teile. Service sollte stets nur von Fachpersonal durchgeführt werden.
2. Vor Feuchtigkeit und Nässe schützen.
3. Falls dieses Gerät ohne Netzstecker geliefert wurde, schließen Sie bitte ein Netzstecker nach folgendem Farbschlüssel an:
  - Braun—stromführend
  - Blau—neutral
  - Grün/Gelb—geerdet
4. **DIESES GERÄT MUSS GEERDET WERDEN.**

**D**

# **Apéndice D**

# **Información Importante De Seguridad**

## **ADVERTENCIA: Para Protección Continua Contra Incendios**

1. Este equipo está diseñado para conectarse a un circuito derivado con protección máxima contra afluxos de al menos 20 amperios.
2. Reemplace *SOLAMENTE* con fusibles que sean del tipo y potencia indicados.

## **ADVERTENCIA: Para La Protección Continua Contra Electrocuciones**

1. El interior de la unidad no contiene repuestos que puedan ser reparados por el usuario. Solicite el servicio de reparación de personal calificado.
2. No exponga la unidad a la lluvia o a la humedad.
3. Si se ha recibido este equipo sin un enchufe macho de cable de alimentación, conecte el enchufe macho de cable alimentación adecuado según los códigos siguientes:
  - MARRÓN - CON CORRIENTE
  - AZUL - NEUTRO
  - VERDE/AMARILLO - TIERRA
4. **ESTE EQUIPO DEBE CONECTARSE A TIERRA.**

# **Appendice D**

# **Información Importante De Seguridad**

## **AVVERTENZA: Per Prevenire Incendi**

1. Questo apparecchio può essere connesso ad un circuito ramificato con una protezione di massima di 20A.
2. Sostituire i fusibili SOLO di tipo e di amperaggio comeda specifica.

## **AVVERTENZA: Per Prevenire Le Scosse Elettriche**

1. L'utente non deve riparare nessuna parte dentro l'unita'. Per qualsiasi riparazione rivolgersi al personale specializzato.
2. Questa apparecchiatura non deve essere esposta ne alla pioggia ne all' umidita'.
3. Nel caso in cui questa apparecchiatura fosse ricevuta senza il debito cavo completo di spina, collegarne uno appropriato seguendo i successivi codici:
  - MARRONE-SOTTO TENSIONE
  - BLU-NEUTRALE
  - VERDE/GIALLO-A TERRA
4. **QUESTA APPARECCHIATURA DEVE METTERSI A TERRA.**

D

# **Appendiks D**

# **Vigtig Sikkerhedsin-**

# **formation: DANMARK**

Advarsel: Beskyttelse mod elektrisk chock.

**Vigtigt!**

Ledere med gul/groen isolation maa kun tilsluttes  
klemme maerket



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